Established by Edward L. Youmans

APPLETONS' POPULAR SCIENCE MONTHLY

EDITED BY

WILLIAM JAY YOUMANS

VOL. LVI

NOVEMBER, 1899, TO APRIL, 1900

NEW YORK

D. APPLETON AND COMPANY

1900

GEORGE M. STERNBERG.

APPLETONS'
POPULAR SCIENCE
MONTHLY.

NOVEMBER, 1899.

THE REAL PROBLEMS OF DEMOCRACY.

By FRANKLIN SMITH.

MUCH has been written of late about "the real problems of democracy." According to some "thinkers," they consist of the invention of ingenious devices to prevent caucus frauds and the purchase of votes, to check the passage of special laws as well as too many laws, and to infuse into decent people an ardent desire to participate in the wrangles of politics. According to others, they consist of the invention of equally ingenious devices to compel corporations to manage their business in accordance with Christian principles, to transform the so-called natural monopolies into either State or municipal monopolies, and to effect, by means of the power of taxation, a more equitable distribution of wealth. According to still others, they consist of the invention of no less ingenious devices to force people to be temperate, to observe humanity toward children and animals, and to read and study what will make them model citizens. It is innocently and touchingly believed that with the solution of these problems, by the application of the authority that society has over the individual, "the social conscience" will be awakened. But such a belief can not be realized. It has its origin in a conception of democracy that has no foundation either in history or science. What are supposed to be the real problems of democracy are only the problems of despotism—the problems to which every tyrant from time immemorial has addressed himself, to the moral and industrial ruin of his subjects.

If democracy be conceived not as a form of political government under the *régime* of universal suffrage, but as a condition of freedom under moral control, permitting every man to do as he likes, so long as he does not trench upon the equal right of every other

man, deliverance from the sophistries and absurdities of current social and political discussion becomes easy and inevitable. Its real problems cease to be an endless succession of political devices that stimulate cunning and evasion, and countless encroachments upon individual freedom that stir up contention and ill feeling. Instead of being innumerable and complex, defying the solvent power of the greatest intellects and the efforts of the most enthusiastic philanthropists, they become few and simple. While their proper solution is beset with difficulties, these difficulties are not as hopeless as the framing of a statute to produce a growth of virtue in a depraved heart. Indeed, no such task has ever been accomplished, and every effort in that direction has been worse than futile. It has encouraged the growth of all the savage traits that ages of conflict have stamped so profoundly in the nervous system of the race. But let it be understood that the real problems of democracy are the problems of self-support and self-control, the problems that appeared with the appearance of human life, and that their sole solution is to be found in the application of precisely the same methods with which Nature disciplines the meanest of her creatures, then we may expect a measure of success from the efforts of social and political reformers; for freedom of thought and action, coupled with the punishment that comes from a failure to comply with the laws of life and the conditions of existence, creates an internal control far more potent than any law. It impels men to depend upon their own efforts to gain a livelihood; it inspires them with a respect for the right of others to do the same.

Simple and commonplace as the traits of self-support and self-control may seem, they are of transcendent importance. Every other trait sinks into insignificance. The society whose members have learned to care for themselves and to control themselves has no further moral or economic conquests to make. It will be in the happy condition dreamed of by all poets, philosophers, and philanthropists. There will be no destitution, for each person, being able to maintain himself and his family, will have no occasion, except in a case of a sudden and an unforeseen misfortune, to look to his friends and neighbors for aid. But in thus maintaining himself—that is, in pursuing the occupation best adapted to his ability and most congenial to his taste—he will contribute in the largest degree to the happiness of the other members of the community. While they are pursuing the occupations best adapted to their ability and most congenial to their tastes, they will be able to obtain from him, as he will be able to obtain from them, those things that both need to supplement the products of

their own industry. Since each will be left in full possession of all the fruits of his own toil, he will be at liberty to make just such use of them as will contribute most to his happiness, thus permitting the realization, in the only practicable way, of Bentham's principle of "the greatest happiness of the greatest number." Since all of them will be free to make such contracts as they believe will be most advantageous to them, exchanging what they are willing to part with for what some one else is willing to give in return, there will prevail the only equitable distribution of the returns from labor and capital. No one will receive more and no one less than he is entitled to. Thus will benefit be in proportion to merit, and the most scrupulous justice be satisfied.

But this *régime* of equity in the distribution of property implies, as I have already said, the possession of a high degree of self-control. Not only must all persons have such a keen sense of their own rights as will never permit them to submit to infringement, but they must have such a keen sense of the rights of others that they will not be guilty themselves of infringement. Not only will they refrain from the commission of those acts of aggression whose ill effects are immediate and obvious; they will refrain from those acts whose ill effects are remote and obscure. Although they will not, for example, deceive or steal or commit personal assaults, they will not urge the adoption of a policy that will injure the unknown members of other communities, like the Welsh tin-plate makers and the Vienna pearl-button makers that the McKinley Bill deprived of employment. Realizing the vice of the plea of the opponents of international copyright that cheap literature for a people is better than scrupulous honesty, they will not refuse to foreign authors the same protection to property that they demand. They will not, finally, allow themselves to take by compulsion or by persuasion the property of neighbors to be used to alleviate suffering or to disseminate knowledge in a way to weaken the moral and physical strength of their fellows. But the possession of a sense of justice so scrupulous assumes the possession of a fellow-feeling so vivid that it will allow no man to refuse all needful aid to the victims of misfortune. As suffering to others will mean suffering to himself, he will be as powerfully moved to go to their rescue as he would to protect himself against the same misfortune. Indeed, he will be moved, as all others will be moved, to undertake without compulsion all the benevolent work, be it charitable or educational, that may be necessary to aid those persons less fortunate than himself to obtain the greatest possible satisfaction out of life.

But the methods of social reform now in greatest vogue do

not contribute to the realization of any such millennium. They are a flagrant violation of the laws of life and the conditions of existence. They make difficult, if not impossible, the establishment of the moral government of a democracy that insures every man and woman not only freedom but also sustentation and protection. In disregard of the principles of biology, which demand that benefit shall be in proportion to merit, the feeble members of society are fostered at the expense of the strong. Setting at defiance the principles of psychology, which insist upon the cultivation of the clearest perception of the inseparable relation of cause and effect and the equally inseparable relation of aggression and punishment, honest people are turned into thieves and murderers, and thieves and murderers are taught to believe that no retribution awaits the commission of the foulest crime. Scornful of the principles of sociology, which teach in the plainest way that the institutions of feudalism are the products of war and can serve no other purpose than the promotion of aggression, a deliberate effort, born of the astonishing belief that they can be transformed into the agencies of progress, is made in time of peace to restore them to life.

To the American Philistine nothing is more indicative of the marvelous moral superiority of this age and country than the rapid increase in the public expenditures for enterprises "to benefit the people." Particularly enamored is he of the showy statistics of hospitals, asylums, reformatories, and other so-called charitable institutions supported by public taxation. "How unselfish we are!" he exclaims, swelling with pride as he points to them. "In what other age or in what other country has so much been done for the poor and unfortunate?" Naught shall ever be said by me against the desire to help others. The fellow-feeling that thrives upon the aid rendered to the sick and destitute I believe to be the most precious gift of civilization. Upon its growth depends the further moral advancement of the race. As I have already intimated, only as human beings are able to represent to themselves vividly the sufferings of others will they be moved to desist from the conduct that contributes to those sufferings. But the system of public charity that prevails in this country is not charity at all; it is a system of forcible public largesses, as odious and demoralizing as the one that contributed so powerfully to the downfall of Athens and Rome. By it money is extorted from the taxpayer with as little justification as the crime of the highwayman, and expended by politicians with as little love as he of their fellows. What is the result? Precisely what might be expected. He is infuriated because of the growing burden of his taxes.

Instead of being made more humane and sympathetic with every dollar he gives under compulsion to the poor and suffering, he becomes more hard-hearted and bitter toward his fellows. The notion that society, as organized at present, is reducing him to poverty and degradation takes possession of him. He becomes an agitator for violent reforms that will only render his condition worse. At the same time the people he aids come to regard him simply as a person under obligations to care for them. They feel no more gratitude toward him than the wolf toward the victim of its hunger and ferocity.

Akin to public charity are all those public enterprises undertaken to ameliorate the condition of the poor—parks, model tenement houses, art galleries, free concerts, free baths, and relief works of all kinds. To these I must add all those Federal, State, and municipal enterprises, such as the post office with the proposed savings attachment, a State system of highways and waterways, municipal water, gas and electric works, etc., that are supposed to be of inestimable advantage to the same worthy class. These likewise fill the heart of the American Philistine with immense satisfaction. Although he finds, by his study of pleasing romances on municipal government in Europe, that we have yet to take some further steps before we fall as completely as the inhabitants of Paris and Berlin into the hands of municipal despotism, he is convinced that we have made gratifying headway, and that the outlook for complete subjection to that despotism is encouraging. But it should be remembered that splendid public libraries and public baths, and extensive and expensive systems of highways and municipal improvements, built under a modified form of the old *corvée*, are no measure of the fellow-feeling and enlightenment of a community. On the contrary, they indicate a pitiful incapacity to appreciate the rights of others, and are, therefore, a measure rather of the low degree of civilization. It should be remembered also, especially by the impoverished victims of the delusions of the legislative philanthropist, that there is no expenditure that yields a smaller return in the long run than public expenditure; that however honest the belief that public officials will do their duty as conscientiously and efficiently as private individuals, history has yet to record the fact of any bureaucracy; that however profound the conviction that the cost of these "public blessings" comes out of the pockets of the rich and is on that account particularly justifiable, it comes largely out of the pockets of the poor; and that by the amount abstracted from the income of labor and capital by that amount is the sum divided between labor and capital reduced.

"But," interposes the optimist, "have the Americans not their great public-school system, unrivaled in the world, to check and finally to end the evils that appear thus far to be inseparably connected with popular government? Is there any truth more firmly established than that it is the bulwark of American institutions, and that if we maintain it as it should be maintained they will be able to weather any storm that may threaten?" Precisely the same argument has been urged time out of mind in behalf of an ecclesiastical system supported at the expense of the taxpayer. Good men without number have believed, and have fought to maintain their belief, that only by the continuance of this form of aggression could society be saved from corruption and barbarism. Even in England to-day, where freedom and civilization have made their most brilliant conquests, this absurd contention is made to bolster up the rotten and tottering union of Church and state, and to justify the seizure of the property of taxpayers to support a particular form of ecclesiastical instruction. But no fact of history has received demonstrations more numerous and conclusive than that such instruction, whether Protestant or Catholic, Buddhist or Mohammedan, in the presence of the demoralizing forces of militant activities, is as impotent as the revolutions of the prayer wheel of a pious Hindu. To whatever country or people or age we may turn, we find that the spirit of the warrior tramples the spirit of the saint in the dust. Despite the lofty teachings of Socrates and Plato, the Athenians degenerated until the name of the Greek became synonymous with that of the blackest knave. With the noble examples and precepts of the Stoics in constant view, the Romans became beastlier than any beast. All through the middle ages and down to the present century the armies of ecclesiastics, the vast libraries of theology, and the myriads of homilies and prayers were impotent to prevent the social degradation that inundated the world with the outbreak of every great conflict. Take, for example, a page from the history of Spain. At the time of Philip II, who tried to make his people as rigid as monks, that country had no rival in its fanatical devotion to the Church, or its slavish observance of the forms of religion. Yet its moral as well as its intellectual and industrial life was sinking to the lowest level. Official corruption was rampant. The most shameless sexual laxity pervaded all ranks. The name of Spanish women, who had "in previous times been modest, almost austere and Oriental in their deportment," became a byword and a reproach throughout the world. "The ladies are naturally shameless," says Camille Borghese, the Pope's delegate to Madrid in 1593, "and even in the streets go up and address men unknown to them, looking upon it

as a kind of heresy to be properly introduced. They admit all sorts of men to their conversation, and are not in the least scandalized at the most improper proposals being made to them." To see how ecclesiastics themselves fall a prey to the ethics of militant activities, becoming as heartless and debauched as any other class, take a page from Italian history at the time of Pope Alexander VI. "Crimes grosser than Scythian," says a pious Catholic who visited Rome, "acts of treachery worse than Carthaginian, are committed without disguise in the Vatican itself under the eyes of the Pope. There are rapines, murders, incests, debaucheries, cruelties exceeding those of the Neros and Caligulas." Similar pages from the history of every other country in Europe given up to war, including Protestant England, might be quoted.

But what is true of ecclesiastical effort in the presence of militant activities is true of pedagogic effort in the presence of political activities. For more than half a century the public-school system in its existing form has been in full and energetic operation. The money devoted to it every year now reaches the enormous total of one hundred and eighty million dollars. Simultaneously an unprecedented extension of secondary education has occurred. Since the war, colleges and universities, supported in whole or in part at the public expense, have been established in more than half of the States and Territories of the Union. To these must be added the phenomenal growth of normal schools, high schools, and academies, and of the equipment of the educational institutions already in existence. Yet, as a result, are the American people more moral than they were half a century ago? Have American institutions—that is, the institutions based upon the freedom of the individual—been made more secure? I venture to answer both questions with an emphatic negative. The construction and operation of the greatest machine of pedagogy recorded in history has been absolutely impotent to stem the rising tide of political corruption and social degeneration. If there are skeptics that doubt the truth of this indictment let them study the criminal history of the day that records the annual commission of more than six thousand suicides and more than ten thousand homicides, and the embezzlement of more than eleven million dollars. Let them study the lying pleas of the commercial interests of the country that demand protection against "the pauper labor of Europe," and thus commit a shameless aggression upon the pauper labor of America. Let them study the records of the deeds of intolerance and violence committed upon workingmen that refuse to exchange their personal liberty for membership of a despotic labor organization. Let them study the columns of the newspapers, crowded with records of crime,

salacious stories, and ignorant comment on current questions and events that appeal to a population as unlettered and base as themselves. Let them study, finally, the appalling indictment of American political life, in a State where the native blood still runs pure in the veins of the majority of the inhabitants, that Mr. John Wanamaker framed in a great speech at the opening of his memorable campaign in Lancaster against the most powerful and most corrupt despotism that can be found outside of Russia or Turkey. "In the fourth century of Rome, in the time of Emperor Theodosius, Hellebichus was master of the forces," he said, endeavoring to describe a condition of affairs that exists in a similar degree in every State in the Union, "and Cæsarius was count of the offices. In the nineteenth century, M. S. Quay is count of the offices, and W. A. Andrews, Prince of Lexow, is master of forces in Pennsylvania, and we have to come through the iron age and the silver age to the worst of all ages—the degraded, evil age of conscienceless, debauched politics. . . . Profligacy and extravagance and boss rule everywhere oppress the people. By the multiplication of indictments your district attorney has multiplied his fees far beyond the joint salaries of both your judges. The administration of justice before the magistrates has degenerated into organized raids on the county treasury. . . . Voters are corruptly influenced or forcibly coerced to do the bidding of the bosses, and thus force the fetters of political vassalage on the freemen of the old guard. School directors, supervisors, and magistrates, and the whole machinery of local government, are involved and dominated by this accursed system."

But Mr. Wanamaker might have added that the whole social and industrial life of the country is involved and dominated by the same system. It is a well-established law of social science that the evil effects of a dominant activity are not confined to the persons engaged in it. Like a contagion, they spread to every part of the social organization, and poison the life farthest removed from their origin. Yet the public-school system, so impotent to save us from social and political degradation and still such an object of unbounded pride and adulation, is, as Mr. Wanamaker, all unconscious of the implication of his scathing criticism, points out in so many words, an integral part of the vast and complex machinery that political despotism has seized upon to plunder and enslave the American people. As in the case of every other extension of the duties of government beyond the limits of the preservation of order and the enforcement of justice, it is an aggression upon the rights of the individual, and, as in the case of every other aggression, contributes powerfully to the decay of national character

and free institutions. It adds thousands upon thousands to the constantly growing army of tax eaters that are impoverishing the people still striving against heavy odds to gain an honest livelihood. It places in the hands of the political despots now ruling the country, without the responsibility that the most odious monarchs have to bear, a revenue and an army of mercenaries that make more and more difficult emancipation from their shackles. It is doing more than anything else except the post-office department to teach people that there is no connection between merit and benefit; that they have the right to look to the State rather than to themselves for maintenance; that they are under no obligations to see that they do not take from others, in the form of salaries not earned nor intended to be earned, what does not belong to them. In the face of this wholesale destruction of fellow-feeling such as occurred in France under the old *régime* and is occurring to-day in Italy and Spain, and the inculcation of the ethics of militant activities, such as may be observed in these countries as well as elsewhere in Europe, is it any wonder that the mind-stuffing that goes on in the public schools has no more effect upon the morals of the American people than the creeds and prayers of the mediæval ecclesiastics that joined in wars and the spoliation of oppressed populations throughout Europe?

Since the path that all people under popular government as well as under forms more despotic are pursuing so energetically and hopefully leads to the certain destruction of the foundations of civilization, what is the path that social science points out? What must they do to prevent the extinction of the priceless acquisition of fellow-feeling, now vanishing so rapidly before the most unselfish efforts to promote it? The supposition is that the social teachings of the philosophy of evolution have no answer to these questions. Believing that they inculcate the hideous *laissez-faire* doctrine of "each for himself and the devil take the hindmost," so characteristic of human relations among all classes of people in this country, the victims of this supposition have repudiated them. But I propose to show that they are the only teachings that give the slightest promise of social amelioration. Although they are ignorantly stigmatized as individualistic, and therefore necessarily selfish and inconsiderate of the welfare of others, they are in reality socialistic in the best sense of the word—that is, they enjoin voluntary, not coercive, co-operation, and insure the noblest humanity and the most perfect civilization, moral as well as material, that can be attained.

Why a society organized upon the individualistic instead of the socialistic basis will realize every achievement admits of easy

explanation. A man dependent upon himself is forced by the struggle for existence to exercise every faculty he possesses or can possibly develop to save himself and his progeny from extinction. Under such pitiless and irresistible pressure he acquires the highest physical and intellectual strength. Thus equipped with weapons absolutely indispensable in any state of society, whether civilized or uncivilized, he is prepared for the conquest of the world. He gains also the physical and moral courage needful to cope with the difficulties that terrify and paralyze the people that have not been subjected to the same rigid discipline. Energetic and self-reliant, he assails them with no thought of failure. If, however, he meets with reverses, he renews the attack, and repeats it until success finally comes to reward his efforts. Such prolonged struggles give steadiness and solidity to his character that do not permit him to abandon himself to trifles or to yield easily, if at all, to excitement and panic. He never falls a victim to Reigns of Terror. The more trying the times, the more self-possessed, clear-headed, and capable of grappling with the situation he becomes, and soon rises superior to it. With every triumph over difficulties there never fails to come the joy that more than balances the pain and suffering endured. But the pain and suffering are as precious as the joy of triumph. Indelibly registered in the nervous system, they enable their victim to feel as others feel passing through the same experience, and this fellow-feeling prompts him to render them the assistance they may need. In this way he becomes a philanthropist. Possessed of the abundant means that the success of his enterprises has placed in his hands, he is in a position to help them to a degree not within the reach nor the desires of the member of the society organized upon the socialistic basis.

In the briefest appeal to history may be found the amplest support for these deductions from the principles of social science. Wherever the individual has been given the largest freedom to do whatever he pleases, as long as he does not trench upon the equal freedom of others, there we witness all those achievements and discover all those traits that indicate an advanced state of social progress. The people are the most energetic, the most resourceful, the most prosperous, the most considerate and humane, the most anxious, and the most competent to care for their less fortunate fellows. On the other hand, wherever the individual has been most repressed, deterred by custom or legislation from making the most of himself in every way, there are to be observed social immobility or retrogression and all the hateful traits that belong to barbarians. The people are inert, slavish, cruel, and superstitious. In the ancient world one type of society is represented by the Egyptians

and Assyrians, and the other by the Greeks and Romans. In the modern world all the Oriental peoples, particularly the Hindus and Chinese, represent the former, and the Occidental peoples, particularly the Anglo-Saxons, represent the latter. So superior, in fact, are the Anglo-Saxons because of their observance of the sacred and fruitful principle of individual freedom that they control the most desirable parts of the earth's surface. If not checked by the practice of a philosophy that has destroyed all the great peoples of antiquity and paralyzed their competitors in the establishment of colonies in the New as well as the Old World, there is no reason to doubt that the time will eventually come when, like the Romans, there will be no other rule than theirs in all the choicest parts of the globe.

It is the immense material superiority of the Anglo-Saxon peoples over all other nations that first arrests attention. No people in Europe possess the capital or conduct the enterprises that the English and Americans do. They have more railroads, more steamships, more factories, more foundries, more warehouses, more of everything that requires wealth and energy than their rivals. Though the fact evokes the sneers of the Ruskins and Carlyles, these enterprises are the indispensable agents of civilization. They have done more for civilization, for the union of distant peoples, and the development of fellow-feeling—for all that makes life worth living—than all the art, literature, and theology ever produced. Without industry and commerce, which these devotees of "the higher life" never weary of deprecating, how would the inhabitants of the Italian republics have achieved the intellectual and artistic conquests that make them the admiration of every historian? The Stones of Venice could not have been written. The artists could not have lived that enabled Vassari to hand his name down to posterity. The new learning would have been a flower planted in a barren soil, and even before it had come to bud it would have fallen withered. May we not, therefore, expect that in like manner the wealth and freedom of the Anglo-Saxon race will bring forth fruits that shall not evoke scorn and contempt? Already their achievements in every field except painting, sculpture, and architecture eclipse those of their rivals. Not excepting the literature of the Greeks, is any so rich, varied, powerful, and voluminous as theirs? If they have no Cæsar or Napoleon, they have a long list of men that have been of infinitely greater use to civilization than those two products of militant barbarism. If judged by practical results, they are without rivals in the work of education. By their inventions and their applications of the discoveries of science they have distanced all competitors in the

race for industrial and commercial supremacy. In the work of philanthropy no people has done as much as they. The volume of their personal effort and pecuniary contributions to ameliorate the condition of the poor and unfortunate are without parallel in the annals of charity. Yet Professor Ely, echoing the opinion of Charles Booth and other misguided philanthropists, has the assurance to tell us that "individualism has broken down." It is the social philosophy that they are trying to thrust upon the world again that stands hopelessly condemned before the remorseless tribunal of universal experience.

In the light thus obtained from science and history, the duty of the American people toward the current social and political philosophy and all the quack measures it proposes for the amelioration of the condition of the unfortunate becomes clear and urgent. It is to pursue without equivocation or deviation the policy of larger and larger freedom for the individual that has given the Anglo-Saxon his superiority and present dominance in the world. To this end they should oppose with all possible vigor every proposed extension of the duty of the state that does not look to the preservation of order and the enforcement of justice. Regarding it as an onslaught of the forces of barbarism, they should make no compromise with it; they should fight it until freedom has triumphed. The next duty is to conquer the freedom they still lack. Here the battle must be for the suppression of the system of protective tariffs, for the transfer to private enterprise and beneficence, the duties of the post office, the public schools, and all public charities, for the repeal of all laws in regulation of trade and industry as well as those in regulation of habits and morals. As an inspiration it should be remembered that the struggle is not only for freedom but for honesty. For the truth can not be too loudly or too often proclaimed that every law taking a dollar from a man without his consent, or regulating his conduct not in accordance with his own notions, but in accordance with those of his neighbors, contributes to the education of a people in idleness and crime. The next duty is to encourage on every hand an appeal to voluntary effort to accomplish all tasks too great for the strength of the individual. Whether those tasks be moral, industrial, or educational, voluntary co-operation alone should assume them and carry them to a successful issue. The government should have no more to do with them than it has to do with the cultivation of wheat or the management of Sunday schools or the suppression of backbiting. The last and final duty should be to cheapen and, as fast as possible, to establish gratuitous justice. With the great diminution of crime that would result from the observance of the

duties already mentioned there would be much less occasion than now to appeal to the courts. But, whenever the occasion arises, it should involve no cost to the person that feels that his rights have been invaded.

Thus will be solved indirectly all the problems of democracy that social and political reformers seek in vain to solve directly. With the diminution of the duties of the state to the preservation of order and the enforcement of justice will be effected a reform as important and far reaching as the suppression of chronic warfare. When politicians are deprived of the immense plunder now involved in political warfare, it will not be necessary to devise futile plans for caucus reform, or ballot reform, or convention reform, or charter reform, or legislative reform. Having no more incentive to engage in their nefarious business than the smugglers that the abolition of the infamous tariff laws banished from Europe, they will disappear among the crowd of honest toilers. The suppression of the robberies of the tax collectors and tax eaters, who have become so vast an army in the United States, will effect also a solution of all labor problems. A society that permits every toiler to work for whomsoever he pleases and for whatever he pleases, protecting him in the full enjoyment of all the fruits of his labor, has done for him everything that can be done. It has taught him self-support and self-control. In thus guaranteeing him freedom of contract and putting an end to the plunder of a bureaucracy and privileged classes of private individuals, the beneficiaries of special legislation, it has effected the only equitable distribution of property possible. At the same time it has accomplished a vastly greater work. As I have shown, the indispensable condition of success of all movements for moral reform is the suppression not only of militant strife, but of political strife. While they prevail, all ecclesiastical and pedagogic efforts to better the condition of society must fail. Despite lectures, despite sermons and prayers, despite also literature and art, the ethics controlling the conduct of men and women will be those of war. But with the abolition of both forms of militant strife it becomes an easy task to teach the ethics of peace, and to establish a state of society that requires no other government than that of conscience. All the forces of industrialism contribute to the work and insure its success.

"This thirst for shooting every rare or unwonted kind of bird," says the author of an article in the London Saturday Review, "is accountable for the disappearance of many interesting forms of life in the British Islands."

AN ENGLISH UNIVERSITY.

BY HERBERT STOTESBURY.

MOST minds in America, as in England, if they think about the subject at all, impute to the two ancient centers of Anglo-Saxon learning—Oxford and Cambridge—an unquestionable supremacy. A halo of greatness surrounds these august institutions, none the less real because to the American mind, at least, it is vague. Half the books students at other institutions require in their various courses have the names of eminent Cambridge or Oxford men upon the fly leaf. Michael Foster's Physiology, Sidgwick's Methods of Ethics, and Bryce's American Commonwealth are recognized text-books wherever the subjects of which they treat are studied; while Sir G. G. Stokes, Jebb, Lord Acton, Caird, Max Müller, and Ray Lankester are as well known to students of Leland Stanford or Princeton as they are to Englishmen. One can scarcely read a work on English literature or open an English novel which does not make some reference to one or other of the great universities or their colleges, inseparably associated as they are with English life and history, past and present. Our oldest college owes its existence to John Harvard, of Emmanuel, Cambridge, and the name of the mother university still clings to her transatlantic offspring. The English institutions have become firmly associated in the vulgar mind with all that is dignified, venerable, and thorough in learning. but, beyond a vague sentiment of admiration, little adequate knowledge on the subject is abroad. American or German universities are organizations not very difficult to comprehend, and a vague knowledge of them is perhaps sufficient. The understanding, however, of those complicated academic communities, Oxford and Cambridge, is a

MICHAEL FOSTER, K. C. B., M. A., F. R. S., Trinity. Professor of Physiology.

matter of intimate experience. They differ widely from their sister institutions in other countries, and in attempting to give some conception of their peculiarities the writer proposes to restrict himself chiefly to Cambridge, because there are not very many striking differences between the latter and Oxford, and because the scientific supremacy of Cambridge is sufficiently established to render her an object of greater interest to the readers of the Science Monthly.

The Right Hon. Lord Acton, M. A., LL. D., Trinity. Professor of Modern History.

First of all, it must be borne in mind that throughout most of their history these institutions have been closely related, not to the body of the people, but to the aristocracy. This was not so much the case at first, before the university became an aggregate of colleges. Then a rather poor and humble class were enabled, through the small expense involved, to acquire the rudiments of an education, and even to become proficient in the scholastic dialectic. But ere long, and with the gradual endowment of different collges, the expenses of a student became much greater, and, save where scholarships could be obtained, it required some affluence before parents could afford to give their sons an academic training. Hence, the more fortunate or aristocratic classes came in time to contribute the large majority of the student body. Those whose intellectual attainments were so unusual as to constitute ways and means have never been debarred, but impecunious mediocrity had and still has little place or opportunity. It is well to remember, in addition, that the Church fostered these universities in their infancy, that it deserves unqualified credit for having nursed them through their early months, and that it continues to have some considerable influence over the modern institutions. Finally, the growth of Cambridge and Oxford has largely been occasioned by lack of rivals in their own class. In this branch or that, other institutions have become deservedly famous. Edinburgh has a

high reputation in moral science; Manchester is renowned for her physics, chemistry, and engineering; and London for her medical schools. But Oxford and Cambridge are strong in many branches. Financially powerful, they are able to attract the majority of promising and eminent men, whence has resulted that remarkable *coterie* of unrivaled intellects through whom the above-named universities are chiefly known to the outer and foreign world. This characteristic has its opposite illustrated in the United States, where the tendency is centrifugal, no one or two universities or colleges having advantages so decided as inevitably to attract most of the best minds, and where, in consequence, the best minds are found scattered from California to Harvard and Pennsylvania.

The characteristic peculiar to Cambridge and Oxford, and which distinguishes them not only from American but also from all other universities in England and elsewhere, is the college system. Thus Cambridge is a collection of eighteen colleges which, though nominally united to form one institution, are really distinct, inasmuch as each is a separate community with its own buildings and grounds, its own resident students, its own lecturers, and Fellows — a community which is supported by its own moneys without aid from the university exchequer, and which in most matters legislates for itself. The system is not unlike the American Union on a small scale, with its cluster of governments and their relation to a supreme center. The advantages of this scheme might theoretically be very great. With each college handsomely endowed and, though managing its own affairs, entering freely, in addition, into those relations of reciprocity which make for the good of the whole, one can readily imagine an ideal academic commonwealth. And while the present condition of the university can scarcely be said to approximate very closely to such an academic Utopia, it yet derives from its

J. J. Thomson, M. A., F. R. S., Trinity.
Professor of Experimental Physics.

constitution numerous obvious advantages which universities otherwise constituted would and do undoubtedly lack. The chief evils besetting the university are perhaps more adventitious than inherent; they are largely financial, and arise from carrying the system of college individualism too far. A description of the college and university organization may make this apparent. By its endowment a college must support a certain number of Fellows and scholars. The latter form a temporary body, while the former are more or less permanent, and therefore upon them devolves the management of the college. Business is usually done by a council chosen from the Fellows, and the election of new Fellows to fill vacancies is made by this select body. The head of a college is known as the master; he is elected by the Fellows save in one or two cases, where his appointment rests with the crown or with certain wealthy individuals. He lives in the college lodge especially built for him, draws a salary large in proportion to the wealth of his college, and exerts an influence corresponding to his intelligence.

G. H. DARWIN, M. A., F. R. S., Trinity.
Plumian Professor of Astronomy.

The Fellows are in most cases chosen from those men who have achieved the greatest success in an honor course. At Cambridge College individualism has progressed so far that the Fellows of, say, Magdalen must be Magdalen men, the students of Queens', St Catherine's, or any other being ineligible save for their own fellowships. Oxford obtains perhaps better men on the whole by throwing open the fellowships of each particular college to the graduates of all, thus producing a wider competition. A fellowship until recently was tenable for life, but it has been reduced to about six years, the Fellows as a whole, however, retaining the power to extend the period of possession. And, further, the holding of a college office for fifteen years in general qualifies for the holding of a fellow-

ship for life, and for a pension as lecturer or tutor. Thus a man is able to devote himself to research with little fear that at the latter end of his career he will lack the means of support. It is perhaps not too much to say that the offices of college dean, tutor, and lecturer are more perquisites than anything else. They are meant to keep and attract men of ability and parts. However, their existence reacts upon the student body by augmenting the expenses of the latter out of proportion to the benefits to be obtained. For instance, instead of utilizing one set of lecturers for one class of subjects, which all students could attend for a small fee, each of the larger colleges, at any rate, pays special lecturers, drawn from its own Fellows, to speak upon the same subjects each to a mere handful of men from their own college only. The tutor is another luxury inherited from the middle ages and therefore retained, and one for which the students have to pay dearly. The chief business of the tutor is not to teach, but to "look after" a certain number of students who are theoretically relegated to his charge. He looks up their lodgings for them, pays their bills at the end of the term, gets them out of scrapes, and draws a large salary. The tutorships seem to the writer to be a good illustration of how an office necessary to one period persists after that for which it was instituted has ceased to exist. When the students of Oxford and Cambridge were many of them thirteen and fourteen years of age, as in the fourteenth century, nurses were doubtless necessary, but they are still retained when the greater maturity of the students renders them not only unnecessary but at times even an impertinence.

The dean is not, as with us, the head of a department; his functions are not so many, his tasks far less onerous. It is before a college dean that students are "hauled" for such offenses as irregularity at chapel, returning to the college after 12 P. M., smoking in college precincts, bringing dogs into the college grounds, and other villainous offenses against regulations. A dean must also attend chapel. Some colleges require two deans to struggle through these complicated and laborious duties, though some possessing only a few dozen students succeed in getting along with one.

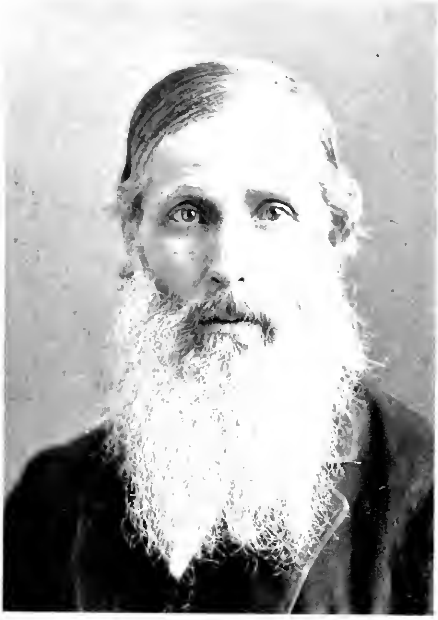
The line of demarcation between the university and the colleges is very distinct. The legislative influence of the former extends over a comparatively restricted field. All professorial chairs and certain lectureships belong to and are paid by the university; the latter has the arranging of the curricula, the care of the laboratories, the disposition of certain noncollegiate scholarships; but, broadly speaking, its two functions are the examination of all students and the conferring of degrees. The supreme legislative body

is the senate, and it is composed of all masters of arts, doctors, and bachelors of divinity whose names still remain on the university books—that is, who continue to pay certain fees into the university treasury. In addition to the legislative body there is an executive head or council of nineteen, including the chancellor—at present the Duke of Devonshire—and the vice-chancellor. Both these bodies must govern according to the statutes, no alteration in which can be effected without recourse being had to Parliament. The senate is a peculiar body, and on occasions becomes somewhat unwieldy. It consists at present of some 6,800 members, of whom only 452 are in residence at Cambridge. Upon ordinary occasions only these 452 vote upon questions proposed by the council; but on occasions of great moment, as when the question of granting university degrees to women came up, some thousands or more of the nonresident members, who in many cases have lost touch with the modern university and modern systems of education, swarm to their alma mater, annihilate the champions of reform, and are hailed by their brethren as the saviors of their university.

R. C. Jebb, Litt. D., M. P., Trinity.
Regius Professor of Greek.

The university's exchequer is supplied partly by its endowment, but chiefly by an assessment on the college incomes, a capitation tax on all undergraduates, and the fees attending matriculation, examinations, and the granting of degrees. The examinations are numerous. Every student on entering is required to pass, or to claim exemption from, an entrance examination. In either case he pays £3 to the university, and upon admission to any honor course or "tripos" to qualify for the degree of Bachelor of Arts £3 more is exacted. The income of the university from these examination fees alone amounts to £9,400 per annum, £4,600 of which goes to pay the examiners. In America this is supposed to be a part of the professor's or instructor's duty, no additional

remuneration is allowed, and hence it does not become necessary to make an additional tax upon the students' resources. The conferring of degrees is also made a very profitable affair. Each candidate for the degree of B. A. pays out £7 to the voracious 'varsity chest, and upon proceeding to the M. A. a further contribution of £12 is requested. In this way the university makes about £12,000 a year, and, as though this was not sufficient, she requires a matriculation fee of £5 for every student who becomes a member. By this means another annual £5,000 is obtained. It must be remembered that these fees are entirely separate from the college fees. When the £5 matriculation for the latter is taken into consideration and the £8 a term (at Trinity) for lectures, two thirds of which the student does not attend, when it is understood that all this and more does not include living expenses, which are by no means slight, and that there are three terms instead of two, as with us, it will be obvious that Cambridge adheres very closely to the rule that to them only who have wealth shall her refining influence be given. That the greatest universities in existence should render it almost totally impossible for aught but the rich to obtain the advantages of their unusual educational facilities jars with that idea of democracy of learning which an American training is apt to foster. But, as we shall point out later, an aristocracy of learning may also have its uses.



Henry Sidgwick, Litt. D., Trinity.
Knightbridge Professor of Moral Philosophy.

With all the revenues the university collects from colleges and students, amounting in all to about £65,000, Cambridge still finds herself poor. Some of the colleges, notably King's and Trinity, are extremely wealthy, but the university remains, if not exactly impecunious, at least on the ragged edge of financial difficulties. The various regius and other professorships, inadequately endowed by the munificence of the crown and of individuals, have each to be

augmented from the university chest. The continual repairing of the old laboratories and scientific apparatus, the salaries to lecturers, to proctors, bedells, and other officers, cause a continual drain on the exchequer, which, with the rapidly growing need for larger laboratories and newer apparatus, has finally resulted in an appeal to the country for the sum of half a million pounds.

It has been seen that the drains on a student's pocket are very considerable at Cambridge, owing to the number of perquisites showered by the colleges on their Fellows, and it may appear that this state of things is unjust and wrong. At present Oxford and Cambridge are practically within the reach of only the moneyed population. According, however, to a plausible and frequently repeated theory, it is not the function of these universities to meet the educational needs of the mediocre poor. The writer's critical attitude toward the financial system in vogue at Cambridge is a proper one, only on the assumption that a maximum of education to all classes alike at a minimum of expense is the final cause and desideratum of a university's existence. But if one assumes that Oxford and Cambridge exist for a different purpose, that the chief end they propose to themselves is individual research, and the advancement, not the promulgation, of learning, it must be admitted that their system has little that is reprehensible. According to this standpoint the students only exist by courtesy of the dons (a name for the Fellows), who have a perfect right to impose upon the students, in return for the condescension which is shown them, what terms they see fit. And they argue that this view is the historic one. The colleges were originally endowed solely for the benefit of a certain limited number of Fellows and scholars. The undergraduate body, as it at present exists, is a later growth, whose eventual existence and the importance of which to the university was probably not anticipated by the college founders. Starting

Donald MacAlister, M. A., M. D., St. Johns. Linacre Lecturer of Physics.

with this, the defenders of the present *régime* would point out, in addition, that there are other English institutions where the poorer classes may be educated, that Cambridge and Oxford are not only not bound to take upon themselves this task, but that they actually subserve a higher purpose and one just as necessary to the development of English science and letters and to the education of the English intellect by specializing in another direction. The good of a philosopher's lifelong reflections, they would say, is not always manifest, but the teachers who instruct the nation's youth are themselves dependent for rational standpoints upon the labor of the greater teacher, and they act as the instruments of communication between the most learned and the unlettered. So Oxford and Cambridge are the sources from whose fountains of wisdom and culture flow streams supplying all the academic mills of Britain, which in their turn are enabled to feed the inhabitants. It would be absurd, they maintain, to insist that the streams and the mills could equally well fulfill the same functions. Cambridge and Oxford instruct just so far as so doing is compatible with what for them is the main end—the furthering of various kinds of research and the offering of all sorts of inducements in order to keep and attract the interested attention of classical butterflies and scientific worms. How well they succeed in this noble ambition is known throughout the civilized world.

Mr. G. H. Darwin, a son of Charles Darwin, has recently had occasion to mention the enormous scientific output of Cambridge University. After saying that the Royal Society is the Academy of Sciences in England, and that in its publications appear accounts of all the most important scientific discoveries in England and most of those in Scotland, Ireland, and other parts of Europe, he goes on to state that he examined the Transactions of this society for three years and discovered that out of the 5,480 pages published in that time 2,418 were contributed by Cambridge men and 1,324 by residents.

In view of these facts, and despite the shortcomings of this university as a teaching institution, it is to be hoped that private generosity will answer her appeal for financial assistance. Her laboratories are a mine of research, and it is in them and in the men who conduct them that Cambridge is perhaps most to be admired.

The Cavendish Laboratory of Physics, where Clerk-Maxwell and afterward Lord Rayleigh taught, and which is at present in the hand of their able successor, J. J. Thomson, is a building of considerable size and admirably fitted out, but the rapidly increasing number of young physicists who are being allured by the working facilities of the place, and by the fame of Professor Thomson, is

rendering even this splendidly equipped hall of science inadequate. The physiological laboratories are many, they are completely furnished with appliances, and a large number of students are there trained annually under the supervision of one of England's most eminent living scientists, Michael Foster, and his scarcely less able associates—Langley, Hardy, and Gaskell. Chemistry, zoölogy, botany, anatomy, and geology have each their well-appointed halls and masterly exponents. The names MacAlister, Liveing, Dewar, Newton, Sedgwick, Marshall Ward, and Hughes are not easily matched in any other one institution. Indeed, it is when one stops to consider the intellects at Cambridge that it becomes a dangerous matter to institute comparisons, and to say that this discipline or that is most rich in eminent interpreters. In science, at any rate, and in all branches of science, Cambridge stands alone. Not even Oxford can be considered for a moment as in the same class with her. And of all the sciences it is undoubtedly in mathematics and astronomy that the supremacy of Cambridge is most pronounced. The names of Profs. Sir G. G. Stokes and Sir R. S. Ball will be familiar to every reader, while those of Profs. Forsythe and G. H. Darwin and Mr. Baker will be familiar to all mathematicians. In classics Cambridge, while not possessing a similar monopoly of almost all the talent, still holds her own even with Oxford. Professors Jebb, Mayor, and Ridgeway, and Drs. Verrall, Jackson, and Frazer constitute a group of men second to none in the subjects of which they treat. Professor Jebb is also one of the university's two representatives in Parliament. In philosophy Cambridge has two men, Henry Sidgwick and James Ward, the former of whom is perhaps by common consent the first living authority on moral science, while the latter ranks among the first of living psychologists. These men, while representing very different philosophical standpoints,

SIR G. G. STOKES, Bart., M. A., LL. D., Sc. D., F. R. S., Pembroke. Lucasian Professor of Mathematics.

unite in opposition not only to the Hegelian movement, which, led by Caird and Bradley of Oxford, Seth and Stirling of Edinburgh, threatens the invasion of England, but also to the Spencerian philosophy. The latter system has not many adherents at either university, but the writer has been told by Professor Sully that the ascendency of the neo-Hegelian and other systems is by no means so pronounced elsewhere in England. The Spencerian biology, on the contrary, has been largely defended at Cambridge, while Weismannism, for the most part, is repudiated there and at Oxford.

The teaching at Cambridge, as at all universities, is of many grades. In many subjects the lectures are not meant to give a student sufficient material to get him through an examination, and a "coach" becomes requisite, or at any rate is employed. This system of coaching has attained large dimensions; its results are often good, but it means an additional expense and seems an incentive to laziness, making it unnecessary for a student to exert his own mental aggressiveness or powers of application as he who fights his own battles must do. The Socratic form of instruction, producing a more intimate and unrestricted relation between instructor and student, and which is largely in operation in the States, is little practiced in England. In science the methods of instruction at Cambridge are ideal. That practical acquaintance with the facts of Nature which Huxley and Tyndall taught is the only true means of knowing Nature, is the key according to which all biological and physical instruction at these institutions is conducted.

James Ward, Sc. D., Trinity.
Professor of Mental Philosophy and Logic.

In the last half dozen years two radical steps have been taken by both Oxford and Cambridge—steps leading, to many respectable minds, in diametrically opposite directions. The step backward (in the writer's view) occurred when the universities, after much excitement, defeated with slaughter the proposition grant-

ing university degrees to women. It was simply proposed that the students of Newnham and Girton, who should successfully compete with male students in an honor course, should have an equal right with the latter to receive the usual degrees from their alma mater. After industrious inquiry among those who were foremost in supporting and opposing this movement the writer has unearthed no objection of weight against the change. "If the women were granted degrees they would have votes in the senate," and "It never has been done"—these are the two reasons most persistently urged in defense of the conservative view; while justice and utility alike appear to be for once, at any rate, unequivocally on the side of the women. Prejudice defeated progress, and students celebrated the auspicious occasion with bonfires. The step forward was taken when the universities and their colleges decided to throw open their gates to the graduates of other universities in England, America, and elsewhere for the purpose of advanced study. But here, as in other things, Cambridge leads the way, and Oxford follows falteringly. The advanced students at Cambridge are treated like Cambridge men, they have the status of Bachelors of Arts, and possess in most respects the advantages, such as they are, of the latter; while at Oxford the advanced students are a restricted class, with restricted advantages, and their relation to the university is not that of the other students. In Cambridge the movement which has resulted in the present admirable condition of affairs was largely brought about by the zeal and enterprise of Dr. Donald MacAlister, of St. John's College, the University Lecturer in Therapeutics, a man of wide sympathies and ability, and whose name is closely associated with this university's metamorphosis into a more modern institution.

THE WONDERFUL CENTURY.*

A REVIEW BY W. K. BROOKS,

PROFESSOR OF ZOÖLOGY IN THE JOHNS HOPKINS UNIVERSITY.

EVERY naturalist has in his heart a warm affection for the author of the Malay Archipelago, and is glad to acknowledge with gratitude his debt to this great explorer and thinker and teacher who gave us the law of natural selection independently of Darwin. When the history of our century is written, the foremost place among those who have guided the thought of their generation and opened new fields for discovery will assuredly be given to Wallace and Darwin.

* Dodd, Mead & Co., New York, 1899.

Few of the great men who have helped to make our century memorable in the history of thought are witnesses of its end, and all who have profited by the labors of Wallace will rejoice that he has been permitted to stand on the threshold of a new century, and, reviewing the past, to give us his impressions of the wonderful century.

We men of the nineteenth century, he says, have not been slow to praise it. The wise and the foolish, the learned and the unlearned, the poet and the pressman, the rich and the poor, alike swell the chorus of admiration for the marvelous inventions and discoveries of our own age, and especially for those innumerable applications of science which now form part of our daily life, and which remind us every hour of our immense superiority over our comparatively ignorant forefathers.

Our century, he tells us, has been characterized by a marvelous and altogether unprecedented progress in the knowledge of the universe and of its complex forces, and also in the application of that knowledge to an infinite variety of purposes calculated, if properly utilized, to supply all the wants of every human being and to add greatly to the comforts, the enjoyments, and the refinements of life. The bounds of human knowledge have been so far extended that new vistas have opened to us in nearly all directions where it had been thought that we could never penetrate, and the more we learn the more we seem capable of learning in the ever-widening expanse of the universe. It may, he says, be truly said of the men of science that they have become as gods knowing good and evil, since they have been able not only to utilize the most recondite powers of Nature in their service, but have in many cases been able to discover the sources of much of the evil that afflicts humanity, to abolish pain, to lengthen life, and to add immensely to the intellectual as well as the physical enjoyments of our race.

In order to get any adequate measure for comparison with the nineteenth century we must take not any preceding century, but the whole preceding epoch of human history. We must take into consideration not only the changes effected in science, in the arts, in the possibilities of human intercourse, and in the extension of our knowledge both of the earth and of the whole visible universe, but the means our century has furnished for future advancement.

Our author, who has borne such a distinguished part in the intellectual progress of our century, shows clearly that in means for the discovery of truth, for the extension of our control over Nature, and for the alleviation of the ills that beset mankind, the inheritance of the twentieth century from the nineteenth will be

greater than our own inheritance from all the centuries that have gone before.

Some may regret that, while only one third of Wallace's book is devoted to the successes of the wonderful century, the author finds the remaining two thirds none too much for the enumeration of some of its most notable failures; but it is natural for one who has borne his own distinguished part in all this marvelous progress to ask where the century has fallen short of the enthusiastic hopes of its leaders, what that it might have done it has failed to do, and what lies ready at the hand of the workers who will begin the new century with this rich inheritance of new thoughts, new methods, and new resources.

The more we realize the vast possibilities of human welfare which science has given us the more, he says, must we recognize our total failure to make any adequate use of them.

Along with this continuous progress in science, in the arts, and in wealth-production, which has dazzled our imaginations to such an extent that we can hardly admit the possibility of any serious evils having accompanied or been caused by it, there has, he says, been many serious failures—intellectual, social, and moral. Some of our great thinkers, he says, have been so impressed by the terrible nature of these failures that they have doubted whether the final result of the work of the century has any balance of good over evil, of happiness over misery, for mankind at large.

Wallace is no pessimist, but one who believes that the first step in retrieving our failures is to perceive clearly where we have failed, for he says there can be no doubt of the magnitude of the evils that have grown up or persisted in the midst of all our triumphs over natural forces and our unprecedented growth in wealth and luxury, and he holds it not the least important part of his work to call attention to some of these failures.

With ample knowledge of the sources of health, we allow and even compel the bulk of our population to live and work under conditions which greatly shorten life. In our mad race for wealth we have made gold more sacred than human life; we have made life so hard for many that suicide and insanity and crime are alike increasing. The struggle for wealth has been accompanied by a reckless destruction of the stored-up products of Nature, which is even more deplorable because irretrievable. Not only have forest growths of many hundred years been cleared away, often with disastrous consequences, but the whole of the mineral treasures of the earth's surface, the slow productions of long-past eras of time and geological change, have been and are still being exhausted with reckless disregard of our duties to posterity and solely in the in-

terest of landlords and capitalists. With all our labor-saving machinery and all our command over the forces of Nature, the struggle for existence has become more fierce than ever before, and year by year an ever-increasing proportion of our people sink into paupers' graves.

When the brightness of future ages shall have dimmed the glamour of our material progress he says that the judgment of history will surely be that our ethical standard was low and that we were unworthy to possess the great and beneficent powers that science had placed in our hands, for, instead of devoting the highest powers of our greatest men to remedy these evils, we see the governments of the most advanced nations arming their people to the teeth and expending most of the wealth and all the resources of their science in preparation for the destruction of life, of property, and of happiness.

He reminds us that the first International Exhibition, in 1851, fostered the hope that men would soon perceive that peace and commercial intercourse are essential to national well-being. Poets and statesmen joined in hailing the dawn of an era of peaceful industry, and exposition following exposition taught the nations how much they have to learn from each other and how much to give to each other for the benefit and happiness of all.

Dueling, which had long prevailed, in spite of its absurdity and harmfulness, as a means of settling disputes, was practically abolished by the general diffusion of a spirit of intolerance of private war; and as the same public opinion which condemns it should, if consistent, also condemn war between nations, many thought they perceived the dawn of a wiser policy between nations.

Yet so far are we from progress toward its abolition that the latter half of the century has witnessed not the decay, but a revival of the war spirit, and at its end we find all nations loaded with the burden of increasing armies and navies.

The armies are continually being equipped with new and more deadly weapons at a cost which strains the resources of even the most wealthy nations and impoverishes the mass of the people by increasing burdens of debt and taxation, and all this as a means of settling disputes which have no sufficient cause and no relation whatever to the well-being of the communities which engage in them.

The evils of war do not cease with the awful loss of life and destruction of property which are their immediate results, since they form the excuse for inordinate increase of armaments—an increase which has been intensified by the application to war purposes of those mechanical inventions and scientific discoveries which,

properly used, should bring peace and plenty to all, but which when seized upon by the spirit of militarism directly lead to enmity among nations and to the misery of the people.

The first steps in this military development were the adoption of a new rifle by the Prussian army in 1846, the application of steam to ships of war in 1840, and the use of armor for battle ships in 1859. The remainder of the century has witnessed a mad race between the nations to increase the death-dealing power of their weapons and to add to the number and efficiency of their armies, while all the resources of modern science have been utilized in order to add to the destructive power of cannon and both the defensive and the offensive power of ships. The inability of industrious laboring men to gain any due share of the benefits of our progress in scientific knowledge is due, beyond everything else, to the expense of withdrawing great armies of men in the prime of life from productive labor, joined to the burden of feeding and clothing them and of keeping weapons and ammunition, ships, and fortifications in a state of readiness, of continually renewing stores of all kinds, of pensions, and of all the laboring men who must, besides making good the destruction caused by war, be withdrawn from productive labor and be supported by others that they may support the army.

And what a horrible mockery is this when viewed in the light of either Christianity or advancing civilization! All the nations armed to the teeth and watching stealthily for some occasion to use their vast armaments for their own aggrandizement and for the injury of their neighbors are Christian nations, but their Christian governments do not exist for the good of the governed, still less for the good of humanity or civilization, but for the aggrandizement and greed and lust of the ruling classes.

The devastation caused by the tyrants and conquerors of the middle ages and of antiquity has been reproduced in our times by the rush to obtain wealth. Even the lust of conquest, in order to obtain slaves and tribute and great estates, by means of which the ruling classes could live in boundless luxury, so characteristic of the earlier civilization, is reproduced in our time.

Witness the recent conduct of the nations of Europe toward Crete and Greece, upholding the most terrible despotism in the world because each hopes for a favorable opportunity to obtain some advantage, leading ultimately to the largest share of the spoil.

Witness the struggles in Africa and Asia, where millions of foreign people may be enslaved and bled for the benefit of their new rulers.

The whole world, says Wallace, is but a gambling table. Just

as gambling deteriorates and demoralizes the individual, so the greed for dominion demoralizes governments. The welfare of the people is little cared for, except so far as to make them submissive taxpayers, enabling the ruling and moneyed classes to extend their sway over new territories and to create well-paid places and exciting work for their sons and relatives.

Hence, says Wallace, comes the force that ever urges on the increase of armaments and the extension of empire. Great vested interests are at stake, and ever-growing pressure is brought to bear upon the too-willing governments in the name of the greatness of the country, the extension of commerce, or the advance of civilization. This state of things is not progress, but retrogression. It will be held by the historian of the future to show that we of the nineteenth century were morally and socially unfit to possess the enormous powers for good and evil which the rapid advance of scientific discovery has given us, that our boasted civilization was in many respects a mere superficial veneer, and that our methods of government were not in accord with either Christianity or civilization.

Comparing the conduct of these modern nations, who call themselves Christian and civilized, with that of the Spanish conquerors of the West Indies, Mexico, and Peru, and making some allowances for differences of race and public opinion, Wallace says there is not much to choose between them.

Wealth and territory and native labor were the real objects in both cases, and if the Spaniards were more cruel by nature and more reckless in their methods the results were much the same. In both cases the country was conquered and thereafter occupied and governed by the conquerors frankly for their own ends, and with little regard for the feelings or the well-being of the conquered. If the Spaniards exterminated the natives of the West Indies, we, he says, have done the same thing in Tasmania and about the same in temperate Australia. Their belief that they were really serving God in converting the heathen, even at the point of the sword, was a genuine belief, shared by priests and conquerors alike—not a mere sham as ours is when we defend our conduct by the plea of "introducing the blessings of civilization."

It is quite possible, says Wallace, that both the conquest of Mexico and Peru by the Spaniards and our conquest of South Africa may have been real steps in advance, essential to human progress, and helping on the future reign of true civilization and the well being of the human race. But if so, we have been and are unconscious agents in hastening the "far-off divine event." We deserve no credit for it. Our aims have been for the most part

sordid and selfish, and our rule has often been largely influenced and often entirely directed by the necessity of finding well-paid places for young men with influence, and also by the constant demands for fresh markets by the influential class of merchants and manufacturers.

More general diffusion of the conviction that while all share the burdens of war, such good as comes from it is appropriated by the few, will no doubt do much to discourage wars; but we must ask whether there may not be another incentive to war which Wallace does not give due weight—whether love of fighting may not have something to do with wars.

As we look backward over history we are forced to ask whether the greed and selfishness of the wealthy and influential and those who hope to gain are the only causes of war. We went to war with Spain because our people in general demanded war. If we have been carried further than we intended and are now fighting for objects which we did not foresee and may not approve, this is no more than history might have led us to expect. War with Spain was popular with nearly all our people a year ago, and, while wise counsels might have stemmed this popular tide, there can be no doubt that it existed, for the evil passions of the human race are the real cause of wars.

The great problem of the twentieth century, as of all that have gone before, is the development of the wise and prudent self-restraint which represses natural passions and appetites for the sake of higher and better ends.

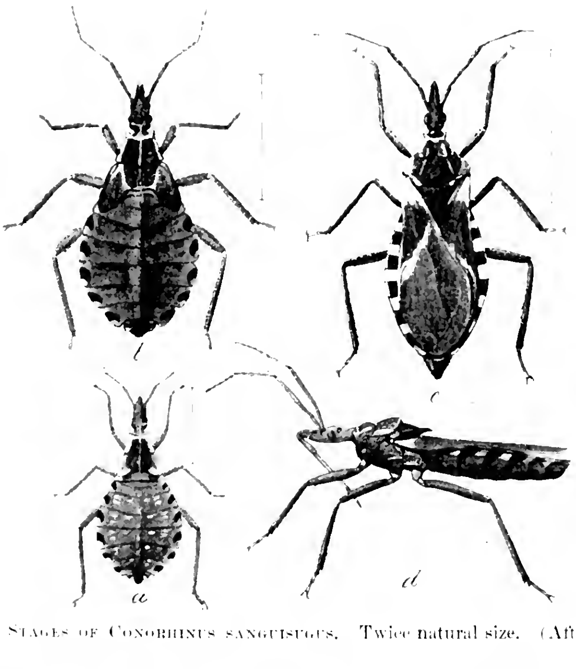
SPIDER BITES AND "KISSING BUGS." *

By L. O. HOWARD,
CHIEF OF THE DIVISION OF ENTOMOLOGY, UNITED STATES DEPARTMENT OF AGRICULTURE.

ON several occasions during the past ten years, and especially at the Brooklyn meeting of the American Association for the Advancement of Science in 1894, the writer has endeavored to show that most of the newspaper stories of deaths from spider bite are either grossly exaggerated or based upon misinformation. He has failed to thoroughly substantiate a single case of death from a so-called spider bite, and has concluded that there is only one spider in the United States which is capable of inflicting a serious bite—viz., *Latrodectus mactans*, a species belonging to a genus of world-wide distribution, the other species of which have universally a

* A paper read before Section F of the American Association for the Advancement of Science at the Columbus meeting in August, 1899.

bad reputation among the peoples whose country they inhabit. In spite of these conclusions, the accuracy of which has been tested with great care, there occur in the newspapers every year stories of spider bites of great seriousness, often resulting in death or the amputation of a limb. The details of negative evidence and of lack of positive evidence need not be entered upon here, except in so far as to state that in the great majority of these cases the spider supposed to have inflicted the bite is not even seen, while in almost no case is the spider seen to inflict the bite: and it is a well-known fact that there are practically no spiders in our more northern States which are able to pierce the human skin, except



Different Stages of Conorhinus sanguisugus. Twice natural size. (After Marlatt.)

upon a portion of the body where the skin is especially delicate and which is seldom exposed. There arises, then, the probability that there are other insects capable of piercing tough skin, the results of whose bites may be more or less painful, the wounds being attributed to spiders on account of the universally bad reputation which these arthropods seem to have.

These sentences formed the introduction to a paper read by the writer at a meeting of the Entomological Society of Washington, held June 1st last. I went on to state that some of these insects are rather well known, as, for example, the blood-sucking cone-nose (*Conorhinus sanguisugus*) and the two-spotted corsairs

(*Rasatus thoracicus* and *R. biguttatus*), both of which occur, however, most numerously in the South and West, and then spoke of *Melanotestis picipes*, a species which had been especially called to my attention by Mr. Frank M. Jones, of Wilmington, Del., who submitted the report of the attending physician in a case of two punctures by this insect inflicted upon the thumb and forefinger of a middle-aged man in Delaware. I further reported upon occasional somewhat severe results from the bites * of the old *Reduvius personatus*, now placed in the genus *Opsicoastes*, and stated that a smaller species, *Coriscus subcoleoptratus*, had bitten me rather severely under circumstances similar to some of those which have given rise in the past to spider-bite stories. In the course of the discussion which followed the reading of this paper, Mr. Schwarz stated that twice during the present spring he had been bitten rather severely by *Melanotestis picipes* which had entered his room, probably attracted by light. He described it as the worst biter among heteropterous insects with which he had had any experience, and said he thought it was commoner than usual in Washington during the present year.

No account of this meeting was published, but within a few weeks thereafter several persons suffering from swollen faces visited the Emergency Hospital in Washington and complained that they had been bitten by some insect while asleep; that they did not see the insect, and could not describe it. This happened during one of the temporary periods when newspaper men are most actively engaged in hunting for items. There was a dearth of news. These swollen faces offered an opportunity for a good story, and thus began the "kissing-bug" scare which has grown to such extraordinary proportions. I have received the following letter and clipping from Mr. J. F. McElhone, of the Washington Post, in reply to a request for information regarding the origin of this curious epidemic:

"WASHINGTON, D. C., *August 14, 1899.*

"*Dr. L. O. Howard, Cosmos Club, Washington, D. C.*

"DEAR SIR: Attached please find clipping from the Washington Post of June 20, 1899, being the first story that ever appeared in print, so far as I can learn, of the depredations of the *Melanotestis picipes*, better known now as the kissing bug. In my rounds as police reporter of the Post, I noticed, for two or three days before writing this story, that the register of the Emergency Hospital of this city contained unusually frequent notes of 'bug-bite'

* When the word "bite" is used in connection with these bugs, it must be remembered that it is really a puncture made with the sharp beak or proboscis (see illustration).

cases. Investigating, on the evening of June 19th I learned from the hospital physicians that a noticeable number of patients were applying daily for treatment for very red and extensive swellings, usually on the lips, and apparently the result of an insect bite. This led to the writing of the story attached.

"Very truly yours,

"JAMES F. McELHONE."

The Washington Post.

TUESDAY, JUNE 20, 1899.

BITE OF A STRANGE BUG.

Several Patients Have Appeared at the Hospitals Very Badly Poisoned.

Lookout for the new bug. It is an insidious insect that bites without causing pain and escapes unnoticed. But afterward the place where it has bitten swells to ten times its normal size. The Emergency Hospital has had several victims of this insect as patients lately and the number is increasing. Application for treatment by other victims are being made at other hospitals, and the matter threatens to become something like a plague. None of those who have been bitten saw the insect whose sting proves so disastrous. One old negro went to sleep and woke up to find both his eyes nearly closed by the swelling from his nose and cheeks, where the insect had alighted. The lips seems to be the favorite point of attack.

William Smith, a newspaper agent, of 327 Trumbull street, went to the Emergency last night with his upper lip swollen to many times its natural size. The symptoms are in every case the same, and there is indication of poisoning from an insect's bite. The matter is beginning to interest the physicians, and every patient who comes in with the now well-known marks is closely questioned as to the description of the insect. No one has yet been found who has seen it.

It would be an interesting computation for one to figure out the amount of newspaper space which was filled in the succeeding two months by items and articles about the "kissing bug." Other Washington newspapers took the matter up. The New York, Philadelphia, and Baltimore papers soon followed suit. The epidemic spread east to Boston and west to California. By "epidemic" is meant the *newspaper* epidemic, for every insect bite where the biter was not at once recognized was attributed to the popular and somewhat mysterious creature which had been given such an attractive name, and there can be no doubt that some mosquito, flea, and bedbug bites which had by accident resulted in a greater than the usual severity were attributed to the prevailing osculatory insect. In Washington professional beggars seized the opportunity, and went around from door to door with bandaged faces and hands, complaining that they were poor men and had been thrown out of work by the results of "kissing-bug" stings! One beggar came to the writer's door and offered, in support of his plea, a card supposed to be signed by the head surgeon of the Emergency Hospital. In a small town in central New York a man arrested on the charge of swindling entered the plea that

he was temporarily insane owing to the bite of the "kissing bug." Entomologists all through the East were also much overworked answering questions asked them about the mysterious creature. Men of local entomological reputations were applied to by newspaper reporters, by their friends, by people who knew them, in church, on the street, and under all conceivable circumstances. Editorials were written about it. Even the Scientific American published a two-column article on the subject; and, while no international complications have resulted as yet, the kissing bug, in its own way and in the short space of two months, produced almost as much of a scare as did the San José scale in its five years of Eastern excitement. Now, however, the newspapers have had their fun, the necessary amount of space has been filled, and the subject has assumed a castaneous hue, to Latinize the slang of a few years back.

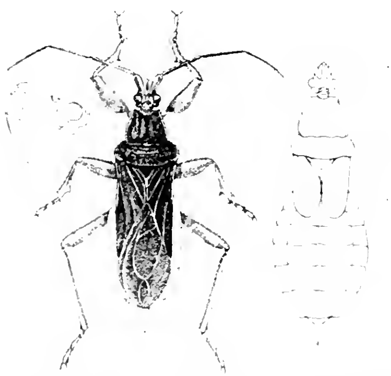
The experience has been a most interesting one. To the reader familiar with the old accounts of the hysterical craze of south Europe, based upon supposed tarantula bites, there can not fail to come the suggestion that we have had in miniature and in modernized form, aided largely by the newspapers, a hysterical craze of much the same character. From the medical and psychological point of view this aspect is interesting, and deserves investigation by competent persons.

As an entomologist, however, the writer confines himself to the actual authors of the bites so far as he has been able to determine them. It seems undoubtedly true that while there has been a great cry there has been very little wool. It is undoubtedly true, also, that there have been a certain number of bites by heteropterous insects, some of which have resulted in considerable swelling. It seems true that *Melanotestis picipes* and *Opsicostes personatus* have been more numerous than usual this year, at least around Washington. They have been captured in a number of instances while biting people, and have been brought to the writer's office for determination in such a way that there can be no doubt about the accuracy of this statement. As the story went West, bites by *Conorhinus sanguisuga* and *Rasatus thoracicus* were without doubt termed "kissing-bug" bites. With regard to other cases, the writer has known of an instance where the mosquito bite upon the lip of a sleeping child produced a very considerable swelling. Therefore he argues that many of these reported cases may have been nothing more than mosquito bites. With nervous and excitable individuals the symptoms of any skin puncture become exaggerated not only in the mind of the individual but in their actual characteristics, and not only does this refer to cases of skin

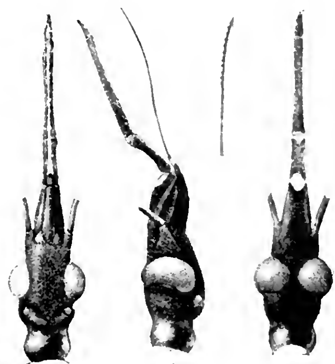
puncture but to certain skin eruptions, and to some of those early summer skin troubles which are known as strawberry rash, etc. It is in this aspect of the subject that the resemblance to tarantulism comes in, and this is the result of the hysterical wave, if it may be so termed.

Six different heteropterous insects were mentioned in the early part of this article, and it will be appropriate to give each of them some little detailed consideration, taking the species of Eastern distribution first, since the scare had its origin in the East, and has there perhaps been more fully exploited.

Opsicoetes personatus, also known as *Reduvius personatus*, and which has been termed the "cannibal bug," is a European species introduced into this country at some unknown date, but possibly following close in the wake of the bedbug. In Europe this species haunts houses for the purpose of preying upon bedbugs. Riley, in his well-known article on Poisonous Insects, published in Wood's Reference Handbook of Medical Science, states that if a fly or another insect is offered to the cannibal bug it is first touched with the antennæ, a sudden spring follows, and at the same time the beak is thrust into the prey. The young specimens are covered



MELANOTLESTIS ABDOMINALIS. Female at right; male at left, with enlarged beak at side. Twice natural size. (Original.)

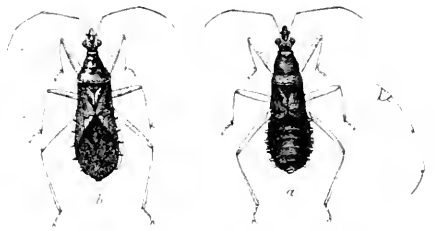


HEAD AND PROBOSCIS OF CONORHINUS SANGUISUGUS. (After Marlatt.)

with a glutinous substance, to which bits of dirt and dust adhere. They move deliberately, with a long pause between each step, the step being taken in a jerky manner. The distribution of the species, as given by Reuter in his Monograph of the Genus *Reduvius*, is Europe to the middle of Sweden, Caucasia, Asia Minor, Algeria, Madeira; North America, Canada, New York, Philadelphia, Indiana; Tasmania, Australia from which it appears that the insect is already practically cosmopolitan, and in fact may almost be

termed a household insect. The collections of the United States National Museum and of Messrs. Heidemann and Chittenden, of Washington, D. C., indicate the following localities for this species: Locust Hill, Va.; Washington, D. C.; Baltimore, Md.; Ithaca, N. Y.; Cleveland, Ohio; Keokuk, Iowa.

The bite of this species is said to be very painful, more so than that of a bee, and to be followed by numbness (Lintner). One of the cases brought to the writer's attention this summer was that of a Swedish servant girl, in which the insect was caught, where the sting was upon the neck, and was followed by considerable swelling. Le Conte, in describing it under the synonymical name *Reduvius pungens*, gives Georgia as the locality, and makes the following statement: "This species is remarkable for the intense pain caused by its bite. I do not know whether it ever willingly plunges its rostrum into any person, but when caught or unskillfully handled it always stings. In this case the pain is almost equal to that of the bite of a snake, and the swelling and irritation which result from it will sometimes last for a week. In very weak and irritable constitutions it may even prove fatal." *



CORISCUS SUBCOLEOPTRATUS: *a*, wingless form; *b*, winged form; *c*, proboscis. All twice natural size. (Original.)

The second Eastern species is *Melanotestis picipes*. This and the closely allied and possibly identical *M. abdominalis* are not rare in the United States, and have been found all along the Atlantic States, in the West and South, and also in Mexico. They live underneath stones and logs, and run swiftly. Both sexes of *M. picipes* in the adult are fully winged, but the female of *M. abdominalis* is usually found in the short-winged condition. Prof. P. R. Uhler writes (in litt.): "*Melanotestis abdominalis* is not rare in this section (Baltimore), but the winged female is a great rarity. At the present time I have not a specimen of the winged female in my collection. I have seen specimens from the South, in North Carolina and Florida, but I do not remember one from Maryland. I am satisfied that *M. picipes* is distinct from *M. abdominalis*. I have not known the two species to unite sexually, but I have seen them both united to their proper consorts. Both species are sometimes found under the same flat stone or log, and they both hiber-

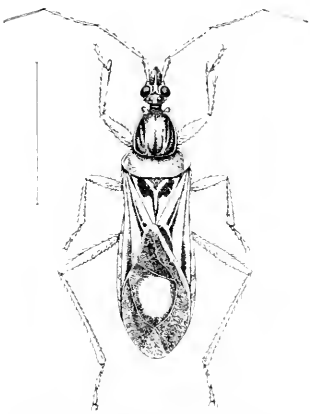
* Proceedings of the Academy of Natural Sciences of Philadelphia, vol. vii, p. 404, 1854–'55.

nate in our valleys beneath stones and rubbish in loamy soils." Specimens in Washington collections show the following localities for *M. abdominalis:* Baltimore, Md.; Washington, D. C.; Wilmington, Del.; New Jersey; Long Island; Fort Bliss, Texas; Louisiana; and Keokuk, Iowa; and for *M. picipes*, Washington, D. C.; Roslyn, Va.; Baltimore, Md.; Derby, Conn.; Long Island; a series labeled New Jersey; Wilmington, Del.; Keokuk, Iowa; Cleveland and Cincinnati, Ohio; Louisiana; Jackson, Miss.; Barton County, Mo.; Fort Bliss, Texas; San Antonio, Texas; Crescent City, Fla.; Holland, S. C.

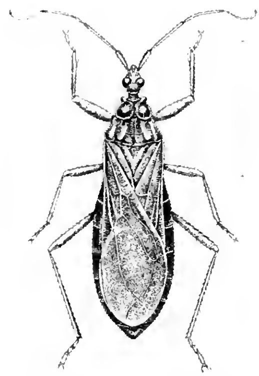
This insect has been mentioned several times in entomological literature. The first reference to its bite probably was made by Townend Glover in the Annual Report of the Commissioner of Agriculture for 1875 (page 130). In Maryland, he states, *M. picipes* is found under stones, moss, logs of wood, etc., and is capable of inflicting a severe wound with its rostrum or piercer. In 1888 Dr. Lintner, in his Fourth Report as State Entomologist of New York (page 110), quotes from a correspondent in Natchez, Miss., concerning this insect: "I send a specimen of a fly not known to us here. A few days ago it punctured the finger of my wife, inflicting a painful sting. The swelling was rapid, and for several days the wound was quite annoying." Until recent years this insect has not been known to the writer as occurring in houses with any degree of frequency. In May, 1895, however, I received a specimen from an esteemed correspondent—Dr. J. M. Shaffer, of Keokuk, Iowa—together with a letter written on May 7th, in which the statement was made that four specimens flew into his window the night before. The insect, therefore, is attracted to light or is becoming attracted to light, is a night-flier, and enters houses through open windows. Among the several cases coming under the writer's observation of bites by this insect, one has been reported by the well-known entomologist Mr. Charles Dury, of Cincinnati, Ohio, in which this species (*M. picipes*) bit a man on the back of the hand, making a bad sore. In another case, where the insect was brought for our determination and proved to be this species, the bite was upon the cheek, and the swelling was said to be great, but with little pain. In a third case, occurring at Holland, S. C., the symptoms were more serious. The patient was bitten upon the end of the middle finger, and stated that the first paroxysm of pain was about like that resulting from a hornet or a bee sting, but almost immediately it grew ten times more painful, with a feeling of weakness followed by vomiting. The pain was felt to shoot up the arm to the under jaw, and the sickness lasted for a number of days. A fourth case, at Fort Bliss,

Texas, is interesting as having occurred in bed. The patient was bitten on the hand, with very painful results and bad swelling.

The third of the Eastern species, *Coriscus subcoleoptratus*, is said by Uhler to have a general distribution in the Northern States, and is like the species immediately preceding a native insect. There is no record of any bite by this species, and it is introduced here for the reason that it attracted the writer's attention crawling upon the walls of an earth closet in Greene County, New York, where on one occasion it bit him between the fingers. The pain was sharp, like the prick of a pin, but only a faint swelling followed, and no further inconvenience. The insect is mentioned,



RASATUS BIGUTTATUS. Twice natural size. (Original.)



REDUVIUS (OPSICOSTES) PERSONATUS. Twice natural size. (Original.)

however, for the reason that, occurring in such situations, it is one of the forms which are liable to carry pathogenic bacteria.

There remain for consideration the Southern and Western forms—*Rasatus thoracicus* and *R. biguttatus*, and *Conorhinus sanguisugus*.

The two-spotted corsair, as *Rasatus biguttatus* is popularly termed, is said by Riley to be found frequently in houses in the Southern States, and to prey upon bedbugs. Lintner, referring to the fact that it preys upon bedbugs, says: "It evidently delights in human blood, but prefers taking it at second hand." Dr. A. Davidson, formerly of Los Angeles, Cal., in an important paper entitled So-called Spider Bites and their Treatment, published in the Therapeutic Gazette of February 15, 1897, arrives at the conclusion that almost all of the so-called spider bites met with in southern California are produced by no spider at all, but by *Rasatus biguttatus*. The symptoms which he describes are as follows: "Next day the injured part shows a local cellulitis, with a central

dark spot; around this spot there frequently appears a bullous vesicle about the size of a ten-cent piece, and filled with a dark grumous fluid; a small ulcer forms underneath the vesicle, the necrotic area being generally limited to the central part, while the surrounding tissues are more or less swollen and somewhat painful. In a few days, with rest and proper care, the swelling subsides, and in a week all traces of the cellulitis are usually gone. In some of the cases no vesicle forms at the point of injury, the formation probably depending on the constitutional vitality of the individual or the amount of poison introduced." The explanation of the severity of the wound suggested by Dr. Davidson, and in which the writer fully concurs with him, is not that the insect introduces any specific poison of its own, but that the poison introduced is probably accidental and contains the ordinary putrefactive germs which may adhere to its proboscis. Dr. Davidson's treatment was corrosive sublimate—1 to 500 or 1 to 1,000—locally applied to the wound, keeping the necrotic part bathed in the solution. The results have in all cases been favorable. Uhler gives the distribution of *R. biguttatus* as Arizona, Texas, Panama, Pará, Cuba, Louisiana, West Virginia, and California. After a careful study of the material in the United States National Museum, Mr. Heidemann has decided that the specimens of *Rasatus* from the southeastern part of the country are in reality Say's *R. biguttatus*, while those from the Southwestern States belong to a distinct species answering more fully, with slight exceptions, to the description of Stal's *Rasatus thoracicus*. The writer has recently received a large series of *R. thoracicus* from Mr. H. Brown, of Tucson, Arizona, and had a disagreeable experience with the same species in April, 1898, at San José de Guaymas, in the State of Sonora, Mexico. He had not seen the insect alive before, and was sitting at the supper table with his host—a ranchero of cosmopolitan language. One of the bugs, attracted by the light, flew in with a buzz and flopped down on the table. The writer's entomological instinct led him to reach out for it, and was warned by his host in the remarkable sentence comprising words derived from three distinct languages: "Guardez, guardez! Zat animalito sting like ze dev!" But it was too late; the writer had been stung on the forefinger, with painful results. Fortunately, however, the insect's beak must have been clean, and no great swelling or long inconvenience ensued.

Perhaps the best known of any of the species mentioned in our list is the blood-sucking cone-nose (*Conorhinus sanguisugus*). This ferocious insect belongs to a genus which has several representatives in the United States, all, however, confined to the South or West. *C. rubro-fasciatus* and *C. variegatus*, as well as *C. san-*

guisugus, are given the general geographical distribution of "Southern States." *C. dimidiatus* and *C. maculipennis* are Mexican forms, while *C. gerstaeckeri* occurs in the Western States. The more recently described species, *C. protractus* Uhl., has been taken at Los Angeles, Cal.; Dragoon, Ariz.; and Salt Lake City, Utah. All of these insects are blood-suckers, and do not hesitate to attack animals. Le Conte, in his original description of *C. sanguisugus*,* adds a most significant paragraph or two which, as it has not been quoted of late, will be especially appropriate here: "This insect, equally with the former" (see above), "inflicts a most painful wound. It is remarkable also for sucking the blood of mammals, particularly of children. I have known its bite followed by very serious consequences, the patient not recovering from its effects for nearly a year. The many relations which we have of spider bites frequently proving fatal have no doubt arisen from the stings of these insects or others of the same genera. When the disease called spider bite is not an anthrax or carbuncle it is undoubtedly occasioned by the bite of an insect—by no means however, of a spider. Among the many species of *Araneidæ* which we have in the United States I have never seen one capable of inflicting the slightest wound. Ignorant persons may easily mistake a *Cimex* for a spider. I have known a physician who sent to me the fragments of a large ant, which he supposed was a spider, that came out of his grandchild's head." The fact that Le Conte was himself a physician, having graduated from the College of Physicians and Surgeons in 1846, thus having been nine years in practice at the time, renders this statement all the more significant. The life history and habits of *C. sanguisugus* have been so well written up by my assistant, Mr. Marlatt, in Bulletin No. 4, New Series, of the Division of Entomology, United States Department of Agriculture, that it is not necessary to enter upon them here. The point made by Marlatt—that the constant and uniform character of the symptoms in nearly all cases of bites by this insect indicate that there is a specific poison connected with the bite—deserves consideration, but there can be no doubt that the very serious results which sometimes follow the bite are due to the introduction of extraneous poison germs. The late Mr. J. B. Lembert, of Yosemite, Cal., noticed particularly that the species of *Conorhinus* occurring upon the Pacific coast is attracted by carrion. Professor Toumey, of Tucson, Arizona, shows how a woman broke out all over the body and limbs with red blotches and welts from a single sting on the shoulders. Specimens of *C. sanguisugus* re-

* Proceedings of the Academy of Natural Sciences of Philadelphia, vol. vii, p. 404, 1854–'55.

ceived in July, 1899, from Mayersville, Miss., were accompanied by the statement—which is appropriate, in view of the fact that the newspapers have insisted that the "kissing bug" prefers the lip—that a friend of the writer was bitten on the lip, and that the effect was a burning pain, intense itching, and much swelling, lasting three or four days. The writer of the letter had been bitten upon the leg and arm, and his brother was bitten upon both feet and legs and on the arm, the symptoms being the same in all cases.

More need hardly be said specifically concerning these biting bugs. The writer's conclusions are that a puncture by any one of them may be and frequently has been mistaken for a spider bite, and that nearly all reported spider-bite cases have had in reality this cause, that the so-called "kissing-bug" scare has been based upon certain undoubted cases of the bite of one or the other of them, but that other bites, including mosquitoes, with hysterical and nervous symptoms produced by the newspaper accounts, have aided in the general alarm. The case of Miss Larson, who died in August, 1898, as the result of a mosquito bite, at Mystic, Conn., is an instance which goes to show that no mysterious new insect need be looked for to explain occasional remarkable cases. One good result of the "kissing-bug" excitement will prove in the end to be that it will have relieved spiders from much unnecessary discredit.

THE MOSQUITO THEORY OF MALARIA.*

By Major RONALD ROSS.

I HAVE the honor to address you, on completion of my term of special duty for the investigation of malaria, on the subject of the practical results as regard the prevention of the disease which may be expected to arise from my researches; and I trust that this letter may be submitted to the Government if the director general thinks fit.

It has been shown in my reports to you that the parasites of malaria pass a stage of their existence in certain species of mosquitoes, by the bites of which they are inoculated into the blood of healthy men and birds. These observations have solved the problem—previously thought insolvable—of the mode of life of these parasites in external Nature.

My results have been accepted by Dr. Laveran, the discoverer of the parasites of malaria; by Dr. Manson, who elaborated the

* A report, published in Nature, from Major Ronald Ross to the Secretary to the Director General, Indian Medical Service, Simla. Dated Calcutta, February 16, 1899.

mosquito theory of malaria; by Dr. Nuttall, of the Hygienic Institute of Berlin, who has made a special study of the relations between insects and disease; and, I understand, by M. Metchnikoff, Director of the Laboratory of the Pasteur Institute in Paris. Lately, moreover, Dr. C. W. Daniels, of the Malaria Commission, who has been sent to study with me in Calcutta, has confirmed my observations in a special report to the Royal Society; while, lastly, Professor Grassi and Drs. Bignami and Bastianelli, of Rome, have been able, after receiving specimens and copies of my reports from me, to repeat my experiments in detail, and to follow two of the parasites of human malaria through all their stages in a species of mosquito called the *Anopheles claviger.*

It may therefore be finally accepted as a fact that malaria is communicated by the bites of some species of mosquito; and, to judge from the general laws governing the development of parasitic animals, such as the parasites of malaria, this is very probably the only way in which infection is acquired, in which opinion several distinguished men of science concur with me.

In considering this statement it is necessary to remember that it does not refer to the mere recurrences of fever to which people previously infected are often subject as the result of chill, fatigue, and so on. When I say that malaria is communicated by the bites of mosquitoes, I allude only to the original infection.

It is also necessary to guard against assertions to the effect that malaria is prevalent where mosquitoes and gnats do not exist. In my experience, when the facts come to be inquired into, such assertions are found to be untrue. Scientific research has now yielded so absolute a proof of the mosquito theory of malaria that hearsay evidence opposed to it can no longer carry any weight.

Hence it follows that, in order to eliminate malaria wholly or partly from a given locality, it is necessary only to exterminate the various species of insect which carry the infection. This will certainly remove the malaria to a large extent, and will almost certainly remove it altogether. It remains only to consider whether such a measure is practicable.

Theoretically the extermination of mosquitoes is a very simple matter. These insects are always hatched from aquatic larvæ or grubs which can live only in small stagnant collections of water, such as pots and tubs of water, garden cisterns, wells, ditches and drains, small ponds, half-dried water courses, and temporary pools of rain-water. So far as I have yet observed, the larvæ are seldom to be found in larger bodies of water, such as tanks, rice fields, streams, and rivers and lakes, because in such places they are devoured by minnows and other small fish. Nor have I ever seen

any evidence in favor of the popular view that they breed in damp grass, dead leaves, and so on.

Hence, in order to get rid of these insects from a locality, it will suffice to empty out or drain away, or treat with certain chemicals, the small collections of water in which their larvæ must pass their existence.

But the practicability of this will depend on circumstances—especially, I think, on the species of mosquito with which we wish to deal. In my experience, different species select different habitations for their larvæ. Thus the common "brindled mosquitoes" breed almost entirely in pots and tubs of water; the common "gray mosquitoes" only in cisterns, ditches, and drains; while the rarer "spotted-winged mosquitoes" seem to choose only shallow rain-water puddles and ponds too large to dry up under a week or more, and too small or too foul and stagnant for minnows.

Hence the larvæ of the first two varieties are found in large numbers round almost all human dwellings in India; and, because their breeding grounds—namely, vessels of water, drains, and wells—are so numerous and are so frequently contained in private tenements, it will be almost impossible to exterminate them on a large scale.

On the other hand, spotted-winged mosquitoes are generally much more rare than the other two varieties. They do not appear to breed in wells, cisterns, and vessels of water, and therefore have no special connection with human habitations. In fact, it is usually a matter of some difficulty to obtain their larvæ. Small pools of any permanence—such as they require—are not common in most parts of India, except during the rains, and then pools of this kind are generally full of minnows which make short work of any mosquito larvæ they may find. In other words, the breeding grounds of the spotted-winged varieties seem to be so isolated and small that I think it may be possible to exterminate this species under certain circumstances.

The importance of these observations will be apparent when I add that hitherto the parasites of human malaria have been found only in spotted-winged mosquitoes—namely, in two species of them in India and in one species in Italy. As a result of very numerous experiments I think that the common brindled and gray mosquitoes are quite innocuous as regards human malaria—a fortunate circumstance for the human race in the tropics; and Professor Grassi seems to have come to the same conclusion as the result of his inquiries in Italy.

But I wish to be understood as writing with all due caution on these points. Up to the present our knowledge, both as regards

the habits of the various species of mosquito and as regards the capacity of each for carrying malaria, is not complete. All I can now say is that if my anticipations be realized—if it be found that the malaria-bearing species of mosquito multiply only in small isolated collections of water which can easily be dissipated—we shall possess a simple mode of eliminating malaria from certain localities.

I limit this statement to certain localities only, because it is obvious that where the breeding pools are very numerous, as in water-logged country, or where the inhabitants are not sufficiently advanced to take the necessary precautions, we can scarcely expect the recent observations to be of much use—at least for some years to come. And this limitation must, I fear, exclude most of the rural areas in India.

Where, however, the breeding pools are not very numerous, and where there is anything approaching a competent sanitary establishment, we may, I think, hope to reap the benefit of these discoveries. And this should apply to the most crowded areas, such as those of cities, towns and cantonments, and also to tea, coffee, and indigo estates, and perhaps to military camps.

For instance, malaria causes an enormous amount of sickness among the poor in most Indian cities. Here the common species of mosquitoes breed in the precincts of almost all the houses, and can therefore scarcely be exterminated; but pools suitable for the spotted-winged varieties are comparatively scarce, being found only on vacant areas, ill-kept gardens, or beside roads in very exceptional positions where they can neither dry up quickly nor contain fish. Thus a single small puddle may supply the dangerous mosquitoes to several square miles containing a crowded population: if this be detected and drained off—which will generally cost only a very few rupees—we may expect malaria to vanish from that particular area.

The same considerations will apply to military cantonments and estates under cultivation. In many such malaria causes the bulk of the sickness, and may often, I think, originate from two or three small puddles of a few square yards in size. Thus in a malarious part of the cantonment of Secunderabad I found the larvæ of spotted-winged mosquitoes only after a long search in a single little pool which could be filled up with a few cart-loads of town rubbish.

In making these suggestions I do not wish to excite hopes which may ultimately prove to have been unfounded. We do not yet know all the dangerous species of mosquito, nor do we even possess an exhaustive knowledge of the haunts and habits of any one

variety. I wish merely to indicate what, so far as I can see at present, may become a very simple means of eradicating malaria.

One thing may be said for certain. Where previously we have been unable to point out the exact origin of the malaria in a locality, and have thought that it rises from the soil generally, we now hope for much more precise knowledge regarding its source; and it will be contrary to experience if human ingenuity does not finally succeed in turning such information to practical account.

More than this, if the distinguishing characteristics of the malaria-bearing mosquitoes are sufficiently marked (if, for instance, they all have spotted wings), people forced to live or travel in malarious districts will ultimately come to recognize them and to take precautions against being bitten by them.

Before practical results can be reasonably looked for, however, we must find precisely—

(*a*) What species of Indian mosquitoes do and do not carry human malaria.

(*b*) What are the habits of the dangerous varieties.

I hope, therefore, that I may be permitted to urge the desirability of carrying out this research. It will no longer present any scientific difficulties, as only the methods already successfully adopted will be required. The results obtained will be quite unequivocal and definite.

But the inquiry should be exhaustive. It will not suffice to distinguish merely one or two malaria-bearing species of mosquito in one or two localities; we should learn to know all of them in all parts of the country.

The investigation will be abbreviated if the dangerous species be found to belong only to one class of mosquito, as I think is likely; and the researches which are now being energetically entered upon in Germany, Italy, America, and Africa will assist any which may be undertaken in India, though there is reason for thinking that the malaria-bearing species differ in various countries

As each species is detected it will be possible to attempt measures at once for its extermination in given localities as an experiment.

I regret that, owing to my work connected with *kala-azar*, I have not been able to advance this branch of knowledge as much during my term of special duty as I had hoped to do; but I think that the solution of the malaria problem which has been obtained during this period will ultimately yield results of practical importance.

FOOD POISONING.

By VICTOR C. VAUGHAN,
PROFESSOR OF HYGIENE IN THE UNIVERSITY OF MICHIGAN.

WITHIN the past fifteen or twenty years cases of poisoning with foods of various kinds have apparently become quite numerous. This increase in the number of instances of this kind has been both apparent and real. In the first place, it is only within recent years that it has been recognized that foods ordinarily harmless may become most powerful poisons. In the second place, the more extensive use of preserved foods of various kinds has led to an actual increase in the number of outbreaks of food poisoning.

The harmful effects of foods may be due to any of the following causes:

1. Certain poisonous fungi may infect grains. This is the cause of epidemics of poisoning with ergotized bread, which formerly prevailed during certain seasons throughout the greater part of continental Europe, but which are now practically limited to southern Russia and Spain. In this country ergotism is practically unknown, except as a result of the criminal use of the drug ergot. However, a few herds of cattle in Kansas and Nebraska have been quite extensively affected with this disease.

2. Plants and animals may feed upon substances that are not harmful to them, but which may seriously affect man on account of his greater susceptibility. It is a well-known fact that hogs may eat large quantities of arsenic or antimony without harm to themselves, and thus render their flesh unfit for food for man. It is believed that birds that feed upon the mountain laurel furnish a food poisonous to man.

3. During periods of the physiological activity of certain glands in some of the lower animals the flesh becomes harmful to man. Some species of fish are poisonous during the spawning season.

4. Both animal and vegetable foods may become infected with the specific germs of disease and serve as the carriers of the infection to man. Instances of the distribution of typhoid fever by the milkman are illustrations of this.

5. Animals may be infected with specific diseases, which may be transmitted to man in the meat or milk. This is one of the means by which tuberculosis is spread.

6. Certain nonspecific, poison-producing germs may find their way into foods of various kinds, and may by their growth produce

chemical poisons either before or after the food has been eaten. This is the most common form of food poisoning known in this country.

We will briefly discuss some foods most likely to prove harmful to man.

Mussel Poisoning.—It has long been known that this bivalve is occasionally poisonous. Three forms of mussel poisoning are recognized. The first, known as *Mytilotoxismus gastricus*, is accompanied by symptoms practically identical with those of cholera morbus. At first there is nausea, followed by vomiting, which may continue for hours. In severe cases the walls of the stomach are so seriously altered that the vomited matter contains considerable quantities of blood. Vomiting is usually accompanied by severe and painful purging. The heart may be markedly affected, and death may result from failure of this organ. Examination after death from this cause shows the stomach and small intestines to be highly inflamed.

The second form of mussel poisoning is known as *Mytilotoxismus exanthematicus* on account of visible changes in the skin. At first there is a sensation of heat, usually beginning in the eyelids, then spreading to the face, and finally extending over the whole body. This sensation is followed by an eruption, which is accompanied by intolerable itching. In severe cases the breathing becomes labored, the face grows livid, consciousness is lost, and death may result within two or three days.

The most frequently observed form of mussel poisoning is that designated as *Mytilotoxismus paralyticus*. As early as 1827 Combe reported his observations upon thirty persons who had suffered from this kind of mussel poisoning. The first symptoms, as a rule, appeared within two hours after eating the poisonous food. Some suffered from nausea and vomiting, but these were not constant or lasting symptoms. All complained of a prickly feeling in the hands, heat and constriction of the throat, difficulty of swallowing and speaking, numbness about the mouth, gradually extending over the face and to the arms, with great debility of the limbs. Most of the sufferers were unable to stand; the action of the heart was feeble, and the face grew pale and expressed much anxiety. Two of the thirty cases terminated fatally. Post-mortem examination showed no abnormality.

Many opinions have been expressed concerning the nature of harmful mussels. Until quite recently it was a common belief that certain species are constantly toxic. Virchow has attempted to describe the dangerous variety of mussels, stating that it has a brighter shell, sweeter, more penetrating, bouillonlike odor than

the edible kind, and that the flesh of the poisonous mussel is yellow; the water in which they are boiled becomes bluish.

However, this belief in a poisonous species is now admitted to be erroneous. At one time it was suggested that mussels became hurtful by absorbing the copper from the bottoms of vessels, but Christison made an analysis of the mussels that poisoned the men mentioned by Combe, with negative results, and also pointed out the fact that the symptoms were not those of poisoning with copper. Some have held that the ill effects were due wholly to idiosyncrasies in the consumers, but cats and dogs are affected in the same way as men are. It has also been believed that all mussels are poisonous during the period of reproduction. This theory is the basis of the popular superstition that shellfish should not be eaten during the months in the name of which the letter "r" does not occur. At one time this popular idea took the form of a legal enactment in France forbidding the sale of shellfish from May 1st to September 1st. This widespread idea has a grain of truth in it, inasmuch as decomposition is more likely to alter food injuriously during the summer months. However, poisoning with mussels may occur at any time of the year.

It has been pretty well demonstrated that the first two forms of mussel poisoning mentioned above are due to putrefactive processes, while the paralytic manifestations seen in other cases are due to a poison isolated a few years ago by Brieger, and named by him mytilotoxin. Any mussel may acquire this poison when it lives in filthy water. Indeed, it has been shown experimentally that edible mussels may become harmful when left for fourteen days or longer in filthy water; while, on the other hand, poisonous mussels may become harmless if kept four weeks or longer in clear water. This is true not only of mussels, but of oysters as well. Some years ago, many cases of poisoning from oysters were reported at Havre. The oysters had been taken from a bed near the outlet of a drain from a public water closet. Both oysters and mussels may harbor the typhoid bacillus, and may act as carriers of this germ to man.

There should be most stringent police regulations against the sale of all kinds of mollusks, and all fish as well, taken from filthy waters. Certainly one should avoid shellfish from impure waters, and it is not too much to insist that those offered for food should be washed in clean water. All forms of clam and oyster broth should be avoided when it has stood even for a few hours at summer heat. These preparations very quickly become infected with bacteria, which develop most potent poisons.

Fish Poisoning.—Some fish are supplied with poisonous glands, by means of which they secure their prey and protect themselves from their enemies. The "dragon weaver," or "sea weaver" (*Trachinus draco*), is one of the best known of these fish. There are numerous varieties widely distributed in salt waters. The poisonous spine is attached partly to the maxilla and partly to the gill cover at its base. This spine is connected with a poisonous gland; the spine itself is grooved and covered with a thin membrane, which converts the grooves into canals. When the point enters another animal its membrane is stripped back and the poison enters the wound. Men sometimes wound their feet with the barbs of this fish while bathing. It also occasionally happens that a fisherman pricks his fingers with one of these barbs. The most poisonous variety of this fish known is found in the Mediterranean Sea. Wounds produced by these animals sometimes cause death. In *Synanceia brachio* there are in the dorsal fin thirteen barbs, each connected with two poison reservoirs. The secretion from these glands is clear, bluish in color, and acid in reaction, and when introduced beneath the skin causes local gangrene and, if in sufficient quantity, general paralysis. In *Plotosus lineatus* there is a powerful barb in front of the ventral fin, and the poison is not discharged unless the end of the barb is broken. The most poisonous variety of this fish is found only in tropical waters. In *Scorpœna scrofa* and other species of this family there are poison glands connected with the barbs in the dorsal and in some varieties in the caudal fin.

A disease known as *kakke* was a few years ago quite prevalent in Japan and other countries along the eastern coast of Asia. With the opening up of Japan to the civilized world the study of this disease by scientific methods was undertaken by the observant and intelligent natives who acquired their medical training in Europe and America. In Tokio the disease generally appears in May, reaches its greatest prevalence in August, and gradually disappears in September and October. The researches of Miura and others have fairly well demonstrated that this disease is due to the eating of fish belonging to the family of *Scombridæ*. There are other kinds of fish in Japanese waters that undoubtedly are poisonous. This is true of the *tetrodon*, of which, according to Remey, there are twelve species whose ovaries are poisonous. Dogs fed upon these organs soon suffered from salivation, vomiting, and convulsive muscular contractions. When some of the fluid obtained by rubbing the ovaries in a mortar was injected subcutaneously in dogs the symptoms were much more severe, and death resulted. Tahara states that he has isolated from the roe of the tetrodon two poisons, one of which is a crystalline base, while the

other is a white, waxy body. From 1885 to 1892 inclusive, 933 cases of poisoning with this fish were reported in Tokio, with a mortality of seventy-two per cent.

Fish poisoning is quite frequently observed in the West Indies, where the complex of symptoms is designated by the Spanish term *siguatera*. It is believed by the natives that the poisonous properties of the fish are due to the fact that they feed upon decomposing medusæ and corals. In certain localities it is stated that all fish caught off certain coral reefs are unfit for food. However, all statements concerning the origin and nature of the poison in these fish are mere assumptions, since no scientific work has been done. Whatever the source of the poison may be, it is quite powerful, and death not infrequently results. The symptoms are those of gastro-intestinal irritation followed by collapse.

In Russia fish poisoning sometimes causes severe and widespread epidemics. The Government has offered a large reward for any one who will positively determine the cause of the fish being poisonous and suggest successful means of preventing these outbreaks. Schmidt, after studying several of these epidemics, states the following conclusions:

(*a*) The harmful effects are not due to putrefactive processes. (*b*) Fish poisoning in Russia is always due to the eating of some member of the sturgeon tribe. (*c*) The ill effects are not due to the method of catching the fish, the use of salt, or to imperfections in the methods of preservation. (*d*) The deleterious substance is not uniformly distributed through the fish, but is confined to certain parts. (*e*) The poisonous portions are not distinguishable from the nonpoisonous, either macroscopically or microscopically. (*f*) When the fish is cooked it may be eaten without harm. (*g*) The poison is an animal alkaloid produced most probably by bacteria that cause an infectious disease in the fish during life.

The conclusion reached by Schmidt is confirmed by the researches of Madame Sieber, who found a poisonous bacillus in fish which had caused an epidemic.

In the United States fish poisoning is most frequently due to decomposition in canned fish. The most prominent symptoms are nausea, vomiting, and purging. Sometimes there is a scarlatinous rash, which may cover the whole body. The writer has studied two outbreaks of this kind of fish poisoning. In both instances canned salmon was the cause of the trouble. Although a discussion of the treatment of food poisoning is foreign to this paper, the writer must call attention to the danger in the administration of opiates in cases of poisoning with canned fish. Vomiting and purging are efforts on the part of Nature to remove the poison, and

should be assisted by the stomach tube and by irrigation of the colon. In one of the cases seen by the writer large doses of morphine had been administered in order to check the vomiting and purging and to relieve the pain; in this case death resulted. The danger of arresting the elimination of the poison in all cases of food poisoning can not be too emphatically condemned.

Meat Poisoning.—The diseases most frequently transmitted from the lower animals to man by the consumption of the flesh or milk of the former by the latter are tuberculosis, anthrax, symptomatic anthrax, pleuro-pneumonia, trichinosis, mucous diarrhœa, and actinomycosis. It hardly comes within the scope of this article to discuss in detail the transmission of these diseases from the lower animals to man. However, the writer must be allowed to offer a few opinions concerning some mooted questions pertaining to the consumption of the flesh of tuberculous animals. Some hold that it is sufficient to condemn the diseased part of the tuberculous cow, and that the remainder may be eaten with perfect safety. Others teach that "total seizure" and destruction of the entire carcass by the health authorities are desirable. Experiments consisting of the inoculation of guinea pigs with the meat and meat juices of tuberculous animals have given different results to several investigators. To one who has seen tuberculous animals slaughtered, these differences in opinion and in experimental results are easily explainable. The tuberculous invasion may be confined to a single gland, and this may occur in a portion of the carcass not ordinarily eaten; while, on the other hand, the invasion may be much more extensive and the muscles may be involved. The tuberculous portion may consist of hard nodules that do not break down and contaminate other tissues in the process of removal, but the writer has seen a tuberculous abscess in the liver holding nearly a pint of broken-down infected matter ruptured or cut in removing this organ, and its contents spread over the greater part of the carcass. This explains why one investigator succeeds in inducing tuberculosis in guinea pigs by introducing small bits of meat from a tuberculous cow into the abdominal cavity, while another equally skillful bacteriologist follows the same details and fails to get positive results. No one desires to eat any portion of a tuberculous animal, and the only safety lies in "total seizure" and destruction. That the milk from tuberculous cows, even when the udder is not involved, may contain the specific bacillus has been demonstrated experimentally. The writer has suggested that every one selling milk should be licensed, and the granting of a license should be dependent upon the application of the tuberculin test to every cow from which

milk is sold. The frequency with which tuberculosis is transmitted to children through milk should justify this action.

That a profuse diarrhœa may render the flesh of an animal unfit food for man was demonstrated by the cases studied by Gärtner. In this instance the cow was observed to have a profuse diarrhœa for two days before she was slaughtered. Both the raw and cooked meat from this animal poisoned the persons who ate it. Medical literature contains the records of many cases of meat poisoning due to the eating of the flesh of cows slaughtered while suffering from puerperal fever. It has been found that the flesh of animals dead of symptomatic anthrax may retain its infection after having been preserved in a dry state for ten years.

One of the most frequently observed forms of meat poisoning is that due to the eating of decomposed sausage. Sausage poisoning, known as *botulismus*, is most common in parts of Germany. Germans who have brought to the United States their methods of preparing sausage occasionally suffer from this form of poisoning. The writer had occasion two years ago to investigate six cases of this kind, two of which proved fatal. The sausage meat had been placed in uncooked sections of the intestines and alternately frozen and thawed and then eaten raw. In this instance the meat was infected with a highly virulent bacillus, which resembled very closely the *Bacterium coli*.

In England, Ballard has reported numerous epidemics of meat poisoning, in most of which the meat had become infected with some nonspecific, poison-producing germ. In 1894 the writer was called upon to investigate cases of poisoning due to the eating of pressed chicken. The chickens were killed Tuesday afternoon and left hanging in a market room at ordinary temperature until Wednesday forenoon, when they were drawn and carried to a restaurant and here left in a warm room until Thursday, when they were cooked (not thoroughly), pressed, and served at a banquet in which nearly two hundred men participated. All ate of the chicken, and were more or less seriously poisoned. The meat contained a slender bacillus, which was fatal to white rats, guinea pigs, dogs, and rabbits.

Ermengem states that since 1867 there have been reported 112 epidemics of meat poisoning, in which 6,000 persons have been affected. In 103 of these outbreaks the meat came from diseased animals, while in only five was there any evidence that putrefactive changes in the meat had taken place. My experience convinces me that in this country meat poisoning frequently results from putrefactive changes.

Instances of poisoning from the eating of canned meats have

become quite common. Although it may be possible that in some instances the ill effects result from metallic poisoning, in a great majority of cases the poisonous substances are formed by putrefactive changes. In many cases it is probable that decomposition begins after the can has been opened by the consumer; in others the canning is imperfectly done, and putrefaction is far advanced before the food reaches the consumer. In still other instances the meat may have been taken from diseased animals, or it may have undergone putrefactive changes before the canning. It should always be remembered that canned meat is especially liable to putrefactive changes after the can has been opened, and when the contents of the open can are not consumed at once the remainder should be kept in a cold place or should be thrown away. People are especially careless on this point. While every one knows that fresh meat should be kept in a cold place during the summer, an open can of meat is often allowed to stand at summer temperature and its contents eaten hours after the can has been opened. This is not safe, and has caused several outbreaks of meat poisoning that have come under the observation of the writer.

Milk Poisoning.—In discussing this form of food poisoning we will exclude any consideration of the distribution of the specific infectious diseases through milk as the carrier of the infection, and will confine ourselves to that form of milk poisoning which is due to infection with nonspecific, poison-producing germs. Infants are highly susceptible to the action of the galactotoxicons (milk poisons). There can no longer be any doubt that these poisons are largely responsible for much of the infantile mortality which is alarmingly high in all parts of the world. It has been positively shown that the summer diarrhœa of infancy is due to milk poisoning. The diarrhœas prevalent among infants during the summer months are not due to a specific germ, but there are many bacteria that grow rapidly in milk and form poisons which induce vomiting and purging, and may cause death. These diseases occur almost exclusively among children artificially fed. It is true that there are differences in chemical composition between the milk of woman and that of the cow, but these variations in percentage of proteids, fats, and carbohydrates are of less importance than the infection of milk with harmful bacteria. The child that takes its food exclusively from the breast of a healthy mother obtains a food that is free from poisonous bacteria, while the bottle-fed child may take into its body with its food a great number and variety of germs, some of which may be quite deadly in their effects. The diarrhœas of infancy are practically confined to the hot months, because a high temperature is essential to the growth

and wide distribution of the poison-producing bacteria. Furthermore, during the summer time these bacteria grow abundantly in all kinds of filth. Within recent years the medical profession has so urgently called attention to the danger of infected milk that there has been a great improvement in the care of this article of diet, but that there is yet room for more scientific and thorough work in this direction must be granted. The sterilization and Pasteurization of milk have doubtlessly saved the lives of many children, but every intelligent physician knows that even the most careful mother or nurse often fails to secure a milk that is altogether safe.

It is true that milk often contains germs the spores of which are not destroyed by the ordinary methods of sterilization and Pasteurization. However, these germs are not the most dangerous ones found in milk. Moreover, every mother and nurse should remember that in the preparation of sterilized milk for the child it is not only necessary to heat the milk, but, after it has been heated to a temperature sufficiently high and sufficiently prolonged, the milk must subsequently be kept at a low temperature until the child is ready to take it, when it may be warmed. It should be borne in mind that the subsequent cooling of the milk and keeping it at a low temperature is a necessary feature in the preparation of it as a food for the infant.

Cheese Poisoning.—Under this heading we shall include the ill effects that may follow the eating of not only cheese but other milk products, such as ice cream, cream custard, cream puffs, etc. Any poison formed in milk may exist in the various milk products, and it is impossible to draw any sharp line of distinction between milk poisoning and cheese poisoning. However, the distinction is greater than is at first apparent. Under the head of milk poisoning we have called especial attention to those substances formed in milk to which children are particularly susceptible, while in cheese and other milk products there are formed poisonous substances against which age does not give immunity. Since milk is practically the sole food during the first year or eighteen months of life, the effect of its poisons upon infants is of the greatest importance; on the other hand, milk products are seldom taken by the infant, but are frequent articles of diet in after life.

In 1884 the writer succeeded in isolating from poisonous cheese a highly active basic substance, to which he gave the name *tyrotoxicon*. The symptoms produced by this poison are quite marked, but differ in degree according to the amount of the poison taken. At first there is dryness of the mouth, followed by constriction of the fauces, then nausea, vomiting, and purging. The first vomited

matter consists of food, then it becomes watery and is frequently stained with blood. The stools are at first semisolid, and then are watery and serous. The heart is depressed, the pulse becomes weak and irregular, and in severe cases the face appears cyanotic. There may be dilatation of the pupil, but this is not seen in all. The most dangerous cases are those in which the vomiting is slight and soon ceases altogether, and the bowels are constipated from the beginning. Such cases as these require prompt and energetic treatment. The stomach and bowels should be thoroughly irrigated in order to remove the poison, and the action of the heart must be sustained.

At one time the writer believed that tyrotoxicon was the active agent in all samples of poisonous cheese, but more extended experimentation has convinced him that this is not the case. Indeed, this poison is rarely found, while the number of poisons in harmful cheese is no doubt considerable. There are numerous poisonous albumins found in cheese and other milk products. While all of these are gastro-intestinal irritants, they differ considerably in other respects.

In 1895 the writer and Perkins made a prolonged study of a bacillus found in cheese which had poisoned fifty people. Chemically the poison produced by this germ is distinguished from tyrotoxicon by the fact that it is not removed from alkaline solution with ether. Physiologically the new poison has a more pronounced effect on the heart, in which it resembles muscarin or neurin more closely than it does tyrotoxicon. Pathologically, the two poisons are unlike, inasmuch as the new poison induces marked congestion of the tissues about the point of injection when used upon animals hypodermically. Furthermore, the intestinal constrictions which are so uniformly observed in animals poisoned by tyrotoxicon was not once seen in our work with this new poison, although it was carefully looked for in all our experiments.

In 1898 the writer, with McClymonds, examined samples of cheese from more than sixty manufacturers in this country and in Europe. In all samples of ordinary American green cheese poisonous germs were found in greater or less abundance. These germs resemble very closely the colon bacillus, and most likely their presence in the milk is to be accounted for by contamination with bits of fecal matter from the cow. It is more than probable that the manufacture of cheese is yet in its infancy, and we need some one to do for this industry what Pasteur did for the manufacture of beer. At present the flavor of a given cheese depends upon the bacteria and molds which accidentally get into it. The time will probably come when all milk used for the manufacture of cheese

will be sterilized, and then selected molds and bacteria will be sown in it. In this way the flavor and value of a cheese will be determined with scientific accuracy, and will not be left to accident.

Canned Foods.—As has been stated, the increased consumption of preserved foods is accountable for a great proportion of the cases of food poisoning. The preparation of canned foods involves the application of scientific principles, and since this work is done by men wholly ignorant of science it is quite remarkable that harmful effects do not manifest themselves more frequently than they do. Every can of food which is not thoroughly sterilized may become a source of danger to health and even to life. It may be of interest for us to study briefly the methods ordinarily resorted to in the preparation of canned foods. With most substances the food is cooked before being put into the can. This is especially true of meats of various kinds. Thorough cooking necessarily leads to the complete sterilization of the food; but after this, it must be transferred to the can, and the can must be properly closed. With the handling necessary in canning the food, germs are likely to be introduced. Moreover, it is possible that the preliminary cooking is not thoroughly done and complete sterilization is not reached. The empty can should be sterilized. If one wishes to understand the *modus operandi* of canning foods, let him take up a round can of any fruit, vegetable, or meat and examine the bottom of the can, which is in reality the top during the process of canning and until the label is put on. The food is introduced through the circular opening in this end, now closed by a piece which can be seen to be soldered on. After the food has been introduced through this opening the can and contents are heated either in a water bath or by means of steam. The opening through which the food was introduced is now closed by a circular cap of suitable size, which is soldered in position.

This cap has near its center a "prick-hole" through which the steam continues to escape. This "prick-hole" is then closed with solder, and the closed can again heated in the water bath or with steam. If the can "blows" (if the ends of the can become convex) during this last heating the "prick-hole" is again punctured and the heated air allowed to escape, after which the "prick-hole" is again closed. Cans thus prepared should be allowed to stand in a warm chamber for four or five days. If the contents have not been thoroughly sterilized gases will be evolved during this time, or the can will "blow" and the contents should be discarded. Unscrupulous manufacturers take cans which have "blown," prick them to allow the escape of the contained gases, and then resterilize the cans with their contents, close them again, and put them

on the market. These "blowholes" may be made in either end of the can, or they may be made in the sides of the can, where they are subsequently covered with the label. Of course, it does not necessarily follow that if a can has "blown" and been subsequently resterilized its contents will prove poisonous, but it is not safe to eat the contents of such cans. Reputable manufacturers discard all "blown" cans.

Nearly all canned jellies sold in this country are made from apples. The apples are boiled with a preparation sold under the trade name "tartarine." This consists of either dilute hydrochloric or sulphuric acid. Samples examined by the writer have invariably been found to consist of dilute hydrochloric acid. The jelly thus formed by the action of the dilute acid upon the apple is converted into quince, pear, pineapple, or any other fruit that the pleasure of the manufacturer may choose by the addition of artificial flavoring agents. There is no reason for believing that the jellies thus prepared are harmful to health.

Canned fruits occasionally contain salicylic acid in some form. There has been considerable discussion among sanitarians as to whether or not the use of this preservative is admissible. Serious poisoning with canned fruits is very rare. However, there can be but little doubt that many minor digestive disturbances are caused by acids formed in these foods. There has been much apprehension concerning the possibility of poisoning resulting from the soluble salts of tin formed by the action of fruit acids upon the can. The writer believes that anxiety on this point is unnecessary, and he has failed to find any positive evidence of poisoning resulting from this cause.

There are two kinds of condensed milk sold in cans. These are known as condensed milk "with" and "without" sugar. In the preparation of the first-mentioned kind a large amount of cane sugar is added to condensed milk, and this acting as a preservative renders the preparation and successful handling of this article of food comparatively easy. On the other hand, condensed milk to which sugar has not been added is very liable to decomposition, and great care must be used in its preparation. The writer has seen several cases of severe poisoning that have resulted from decomposed canned milk. Any of the galactotoxicons (milk poisons) may be formed in this milk. In these instances the cans were "blown," both ends being convex.

One of the most important sanitary questions in which we are concerned to-day is that pertaining to the subject of canned meats. It is undoubtedly true that unscrupulous manufacturers are putting upon the market articles of this kind of food which no decent

man knowingly would eat, and which are undoubtedly harmful to all.

The knowledge gained by investigations in chemical and bacteriological science have enabled the unscrupulous to take putrid liver and other disgusting substances and present them in such a form that the most fastidious palate would not recognize their origin. In this way the flesh from diseased animals and that which has undergone putrefactive changes may be doctored up and sold as reputable articles of diet. The writer does not believe that this practice is largely resorted to in this country, but that questionable preservatives have been used to some extent has been amply demonstrated by the testimony of the manufacturers of these articles themselves, given before the Senate committee now investigating the question of food and food adulterations. It is certainly true that most of the adulterations used in our foods are not injurious to health, but are fraudulent in a pecuniary sense; but when the flesh of diseased animals and substances which have undergone putrefactive decomposition can be doctored up and preserved by the addition of such agents as formaldehyde, it is time that the public should demand some restrictive measures.

WIRELESS TELEGRAPHY.

By Prof. JOHN TROWBRIDGE,
DIRECTOR OF JEFFERSON PHYSICAL LABORATORY, HARVARD UNIVERSITY.

I NEVER visit the historical collection of physical apparatus in the physical laboratory of Harvard University without a sense of wonderment at the marvelous use that has been made of old and antiquated pieces of apparatus which were once considered electrical toys. There can be seen the first batteries, the model of dynamo machines, and the electric motor. Such a collection is in a way a Westminster Abbey—dead mechanisms born to new uses and a great future.

There is one simple piece of apparatus in the collection, without which telephony and wireless telegraphy would be impossible. To my mind it is the most interesting skeleton there, and if physicists marked the resting places of their apparatus laid to apparent rest and desuetude, this merits the highest sounding and most suggestive inscription. It is called a transformer, and consists merely of two coils of wire placed near each other. One coil is adapted to receive an electric current; the other coil, entirely independent of the first, responds by sympathy, or what is called induction,

across the space which separates the coils. Doubtless if man knew all the capabilities of this simple apparatus he might talk to China, or receive messages from the antipodes. He now, by means of it, analyzes the light of distant suns, and produces the singular X

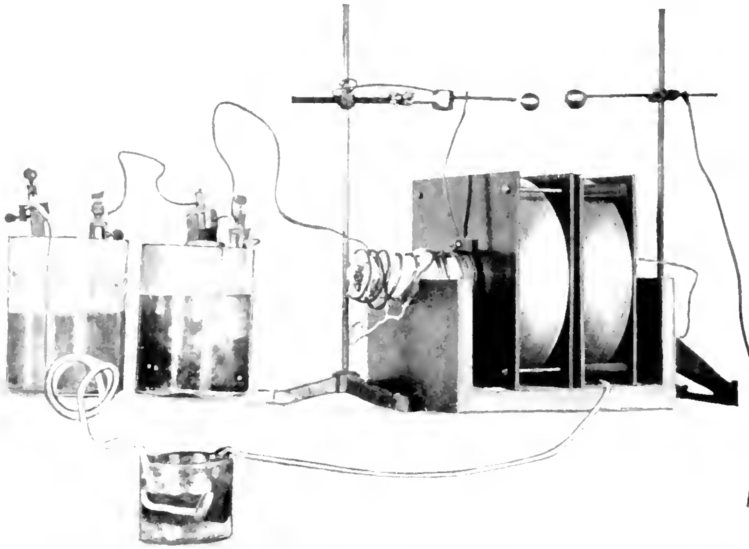


FIG. 1.—Disposition of batteries and coils at the sending station, showing the arrangement of the vertical wire and the spark gap.

rays which enable him to see through the human body. By means of it he already communicates his thoughts between stations thousands of miles apart, and by means of its manifestations I hope to make this article on wireless telegraphy intelligible. My essay can be considered a panegyric of this buried form—a history of its new life and of its unbounded possibilities.

For convenience, one of the coils of the transformer is placed inside the other, and the combination is called a Ruhmkorf coil. It is represented in the accompanying photograph (Fig. 1), with batteries attached to the inner coil, while the outer coil is connected to two balls, between which an electric spark jumps whenever the battery circuit is broken. In fact, any disturbance in the battery circuit—a weakening, a strengthening, or a break—provided that the changes are sudden, produces a corresponding change in the neighboring circuit. One coil thus responds to the other, in some mysterious way, across the interval of air which separates them. Usually the coils are placed very near to each other—in fact, one embraces the other, as shown in the photograph.

The coils, however, if placed several miles apart, will still re-

spond to each other if they are made sufficiently large, if they are properly placed, and if a powerful current is used to excite one coil. Thus, by simply varying the distance between the coils of wire we can send messages through the air between stations which are not connected with a wire. This method, however, does not constitute the system of wireless telegraphy of Marconi, which it is the object of this paper to describe. Marconi has succeeded in transmitting messages over forty miles between points not connected by wires, and he has accomplished this feat by merely slightly modifying the disposition of the coils, thus revealing a new possibility of the wondrous transformer. If the reader will compare the following diagram (Fig. 2) with the photograph (Fig. 1), he will see how simple the sending apparatus of Marconi is.

S is a gap between the ends of one coil, across which an electric spark is produced whenever the current from the batteries B flowing through the coil C is broken by an arrangement at D. This break produces an electrical pulsation in the coil C′, which travels up and down the wire W, which is elevated to a considerable height above the ground. This pulsation can not be seen by the eye. The wire does not move; it appears perfectly qui-

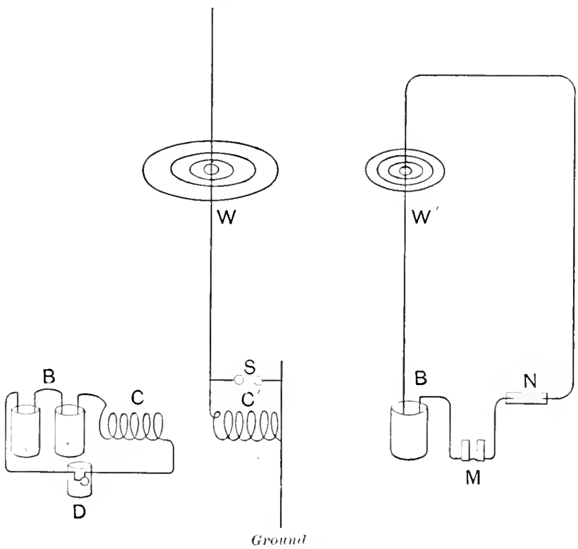


FIG. 2.—Diagram of the arrangement of wires and batteries at the receiving station.

escent and dead, and seems only a wire and nothing more. At night, under favorable circumstances, one could see a luminosity on the wire, especially at the end, when messages are being transmitted, by a powerful battery B.

It is very easy to detect the electric lines which radiate from

every part of such a wire when a spark jumps between the terminals S of the coil. All that is necessary to do is to pass the wire through a sensitive film and to develop the film. The accompanying photograph (Fig. 3) was taken at the top of such a wire, by means of a very powerful apparatus at my command. When the photograph is examined with a microscope the arborescent electric lines radiating from the wire, like the rays of light from a star, exhibit a beautiful fernlike structure. These lines, however, are not chiefly instrumental in transmitting the electric pulse across space.

There are other lines, called magnetic lines of force, which emanate from every portion of the vertical wire W just as ripples spread out on the surface of placid water when it is disturbed by the fall of a stone. These magnetic ripples travel in the ether of space, and when they embrace a neighboring wire or coil they produce similar ripples, which whirl about the distant wire and produce in some strange way an electrical current in the wire. These magnetic pulsations can travel great distances.

In the photographs of these magnetic whirls, Fig. 4 is the whirl produced in the circuit C′ by the battery B (Fig. 2), while Fig. 5 is that produced by electrical sympathy, or as it is called induction, in a neighboring wire. These photographs were obtained by passing the circuits through the sensitive films, perpendicularly to the latter, and then sprinkling very fine iron filings on these surfaces and exposing them to the light. In order to obtain these photographs a very powerful electrical current excited the coil C′ (Fig. 2), and the neighboring circuit W′ (Fig. 5) was placed very near the circuit W.

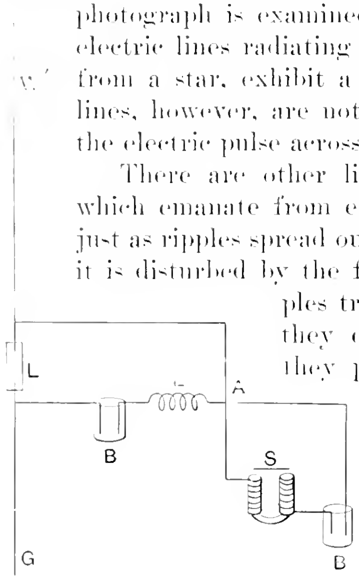


Fig. 2a represents a more complete electrical arrangement of the receiver circuit. The vertical wire, W, is connected to one wire of the coherer, L. The other wire of the coherer is led to the ground, G. The wires in the coherer, L, are separated by fine metallic particles. B represents a battery. E, an electro-magnet which attracts a piece of iron, A (armature), and closes a local battery, B, causing a click of the sounder (electro-magnet), S. The magnetic waves (Fig. 5) embracing the wire, W, cause a pulsation in this wire which produces an electrical disturbance in the coherer analogous to that shown in Fig. 3, by means of which an electrical current is enabled to pass through the electro-magnet, E.

When the receiving wire is at the distance of several miles from the sending wire it is impossible to detect by the above method the magnetic ripples or whirls. We can, however, detect the electrical currents which these magnetic lines of force cause in the receiving wire: and this leads me to speak of the discovery

of a remarkable phenomenon which has made Marconi's system of wireless telegraphy possible. In order that an electrical current may flow through a mass of particles of a metal, a mass, for instance, of iron filings, it is necessary either to compress them or to cause a minute spark or electrical discharge between the particles. Now, it is supposed that the magnetic whirls, in embracing the distant receiving circuit, cause these minute sparks, and thus enable the electric current from the battery B to work a telegraphic sounder or bell M. The metallic filings are inclosed in a glass tube

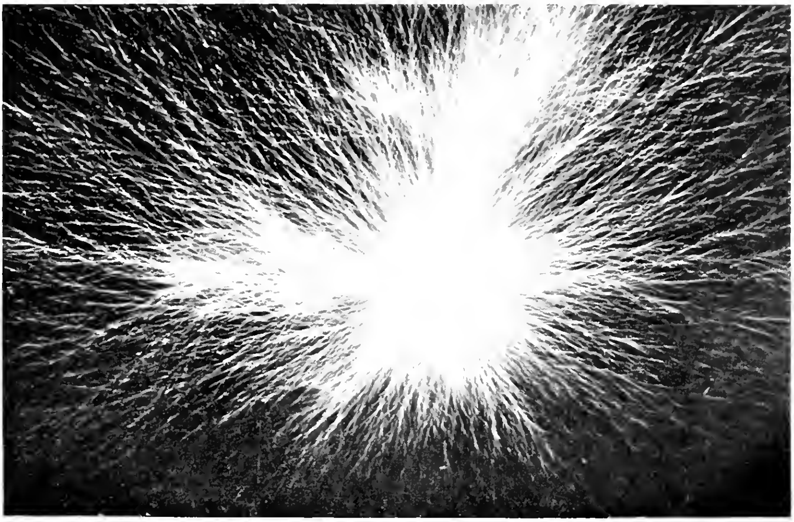


Fig. 3.—Photograph of the electric lines which emanate from the end of the wire at the sending station, and which are probably reproduced among the metallic filings of the coherer at the receiving station.

between wires which lead to the battery, and the arrangement is called a coherer. It can be made small and light. Fig. 6 is a representation in full size of one that has been found to be very sensitive. It consists of two silver wires with a few iron filings contained in a glass tube between the ends of the wires. It is necessary that this little tube should be constantly shaken up in order that after the electrical circuit is made the iron filings should return to their non-conducting condition, or should cease to cohere together, and should thus be ready to respond to the following signal. My colleague, Professor Sabine, has employed a very small electric motor to cause the glass tube to revolve, and thus to keep the filings in motion while signals are being received. Fig. 7 shows the arrangement of the receiving apparatus.

The coherer and the motor are shown between two batteries, one of which drives the motor while the other serves to work the

bell or sounder when the electric wire excites the iron filings. In Fig. 2 this receiving apparatus is shown diagrammatically. B is the battery which sends a current through the sounder M and the

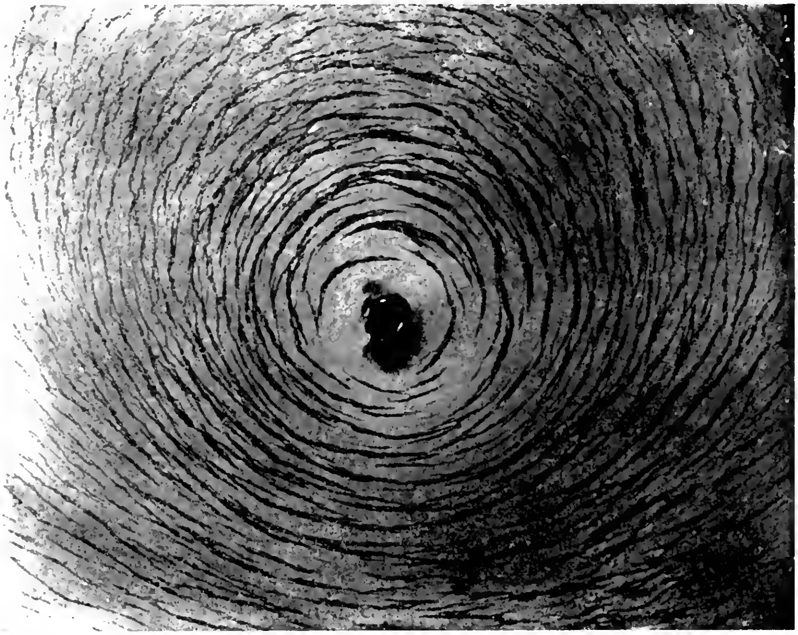


Fig. 4.—Magnetic whirls about the sending wire.

coherer X when the magnetic whirls coming from the sending wire W embrace the receiving wire W'.

The term wireless telegraphy is a misnomer, for without wires the method would not be possible. The phenomenon is merely an enlargement of one that we are fully conscious of in the case of telegraph and telephone circuits, which is termed electro-magnetic induction. Whenever an electric current suddenly flows or suddenly ceases to flow along a wire, electrical currents are caused by induction in neighboring wires. The receiver employed by Marconi is a delicate spark caused by this induction, which forms a bridge so that an electric current from the relay battery can pass and influence magnetic instruments.

Many investigators had succeeded before Marconi in sending telegraphic messages several miles through the air or ether between two points not directly connected by wires. Marconi has extended the distance by employing a much higher electro-motive force at the sending station and using the feeble inductive effect at a distance to set in action a local battery.

It is evident that wires are needed at the sending station from every point of which magnetic and electric waves are sent out, and wires at the receiving station which embrace, so to speak, these waves in the manner shown by our photographs. These waves produce minute sparks in the receiving instrument, which act like a suddenly drawn flood gate in allowing the current from a local battery to flow through the circuit in which the spark occurs, and thus produce a click on a telegraphic instrument.

We have said that messages had been sent by what is called wireless telegraphy before Marconi made his experiments. These messages had also been sent by induction, signals on one wire being received by a parallel and distant wire. To Marconi is due the credit of greatly extending the method by using a vertical wire. The method of using the coherer to detect electric pulses is not due, however, to Marconi. It is usually attributed to Branly;

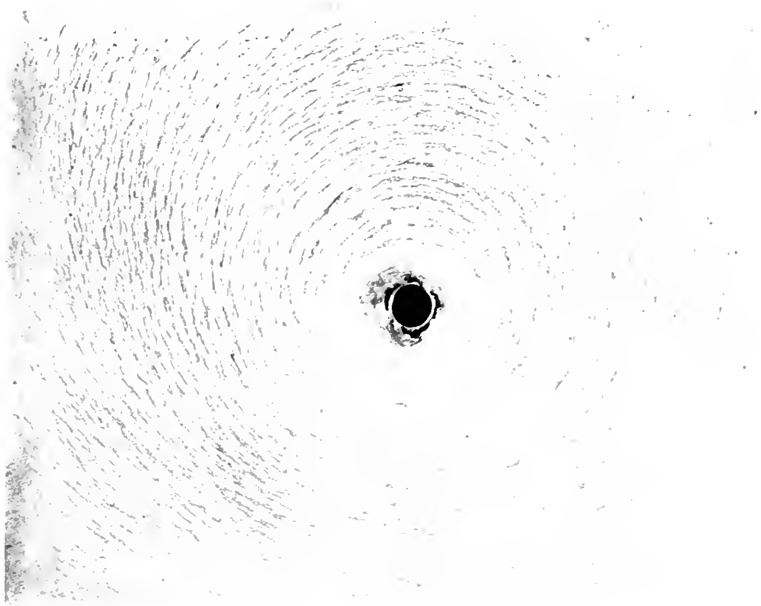


Fig. 5.—Magnetic whirls about the receiving wire.

it had been employed, however, by previous observers, among whom is Hughes, the inventor of the microphone, an instrument analogous in its action to that of the coherer. In the case of the microphone, the waves from the human voice shake up the particles of carbon in the microphone transmitter, and thus cause an electrical current to flow more easily through the minute contacts of the carbon particles.

The action of the telephone transmitter, which also consists of minute conducting particles in which a battery terminals are immersed, and the analogous coherer is microscopic, and there are many theories to account for their changes of resistance to electrical currents. We can not, I believe, be far wrong in thinking that the electric force breaks down the insulating effect of the infinitely thin layers of air between the particles, and thus allows an electric current to flow. This action is doubtless of the nature of an electric spark. An electric spark, in the case of wireless telegraphy, produces magnetic and electric lines of force in space, these reach out and embrace the circuit containing the coherer, and produce in turn minute sparks. *Similia similibus*—one action perfectly corresponds to the other.

The Marconi system, therefore, of what is called wireless telegraphy is not new in principle, but only new in practical application. It had been used to show the phenomena of electric waves in lecture rooms. Marconi extended it from distances of sixty to one hundred feet to fifty or sixty miles. He did this by lifting the sending-wire spark on a lofty pole and improving the sensitiveness of the metallic filings in the glass tube at the receiving station.

FIG. 6.—The coherer employed to receive the electric waves. (One and a third actual size.)

He adopted a mechanical arrangement for continually tapping the coherer in order to break up the minute bridges formed by the cohering action, and thus to prepare the filings for the next magnetic pulse. The system of wireless telegraphy is emphatically a spark system strangely analogous to flash-light signaling, a system in which the human eye with its rods and cones in the retina acts as the coherer, and the nerve system, the local battery, making a signal or sensation in the brain.

Let us examine the sending spark a little further. An electric spark is perhaps the most interesting phenomenon in electricity. What causes it—how does the air behave toward it—what is it that apparently flows through the air, sending out light and heat waves as well as magnetic and electric waves? If we could answer all these questions, we should know what electricity is. A critical study of the electric spark has not only its scientific but its practical side. We see the latter side evidenced by its employment in wireless telegraphy and in the X rays; for in the latter case we have an electric discharge in a tube from which the air is removed—a special case of an electric spark. In

order to understand the capabilities of wireless telegraphy we must turn to the scientific study of the electric spark; for its practical employment resides largely in its strength, in its frequency in its position, and in its power to make the air a conductor for electricity. All these points are involved in wireless telegraphy. How, then, shall we study the electric spark? The eye sees only an instantaneous flash following a devious path. It can not tell in what direction a spark flies (a flash of lightning, for instance), or indeed whether it has a direction. There is probably no commoner fallacy mankind entertains than the belief that the direction of lightning, or any electric spark, can be ascertained by the eye—that is, the direction from the sky to the earth or from the earth to the sky.

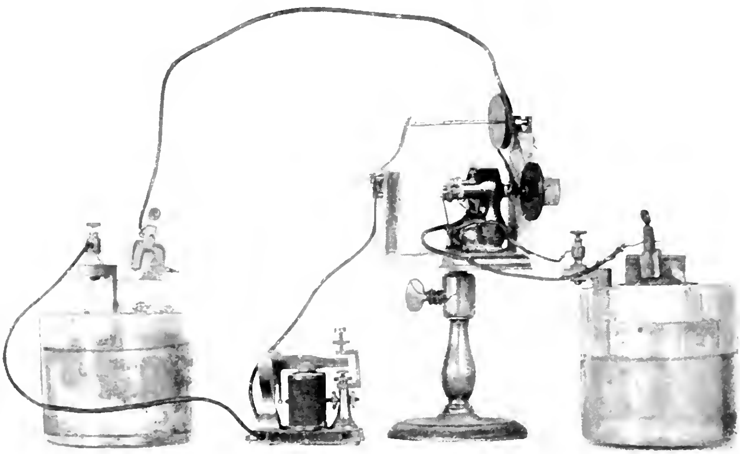


Fig. 7.—Arrangement of batteries of motor (to disturb the coherer) and the sounder by which the messages are received.

I have repeatedly tested numbers of students in regard to this question, employing sparks four to six feet in length, taking precautions in regard to the concealment of the directions in which I charged the poles of the charging batteries, and I have never found a consensus of opinion in regard to directions. The ordinary photograph, too, reveals no more than the eye can see—a brilliant, devious line or a flaming discharge.

A large storage battery forms the best means of studying electric sparks, for with it one can run the entire gamut of this phenomenon—from the flaming discharge which we see in the arc light on the street to the crackling spark we employ in wireless telegraphy, and the more powerful discharges of six or more feet in length which closely resemble lightning discharges. A critical study of this gamut throws considerable light on the problem of the possibility

of secret wireless telegraphy—a problem which it is most important to solve if the system is to be made practical; for at present the message spreads out from the sending spark in great circular ripples in all directions, and may be received by any one.

Several methods enable us to transform electrical energy so as to obtain suitable quick and intense blows on the surrounding medium. Is it possible that there is some mysterious vibration in the spark which is instrumental in the effective transmission of electrical energy across space? If the spark should vibrate or oscillate to and fro faster than sixteen times a second the human eye could not detect such oscillations; for an impression remains on the eye one sixteenth of a second, and subsequent ones separated by intervals shorter than a sixteenth would mingle together and could not be separated. The only way to ascertain whether the spark is oscillatory, or whether it is not one spark, as it appears to the eye, but a number of to-and-fro impulses, is to photograph it by a rapidly revolving mirror. The principle is similar to that of the biograph or the vitoscope, in which the quick to-and-fro motions of the spark are received on a sensitive film, which is in rapid motion. One terminal of the spark gap, the positive terminal so called, is always brighter than the other. Hence, if the sensitive film is moved at right angles to the path of the discharge, we shall get a row of dots which are the images of the brighter terminal, and these dots occur alternately first on one terminal and then on the other, showing that the discharge oscillates—that is, leaps in one discharge

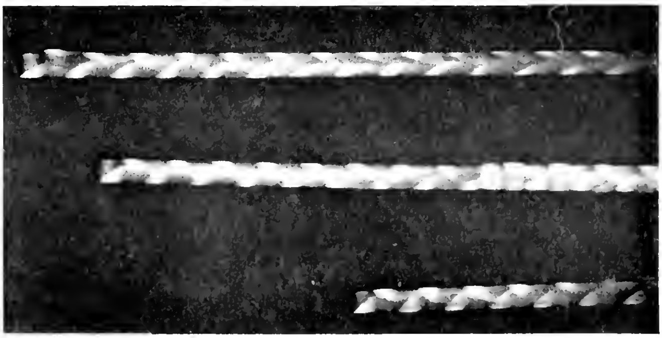


Fig. 8.—Photograph of electrical pulses. The interval between the pulses is one millionth of a second.

(which seems but one to the eye) many times in a hundred thousandth of a second. In practice it is found better to make an image of the spark move across the sensitive film instead of moving the film. This is accomplished by the same method that a boy uses in flashing sunlight by means of a mirror. The faster the mirror

moves the faster moves the image of the light. In this way a speed of a millionth of a second can be attained. In this case the distance between the dots on the film may be one tenth of an inch, sufficient to separate them to the eye. The photograph of electric sparks (Fig. 8) was taken in this manner. The distance between any two bright spots in the trail of the photographic images represents the time of the electric oscillation or the time of

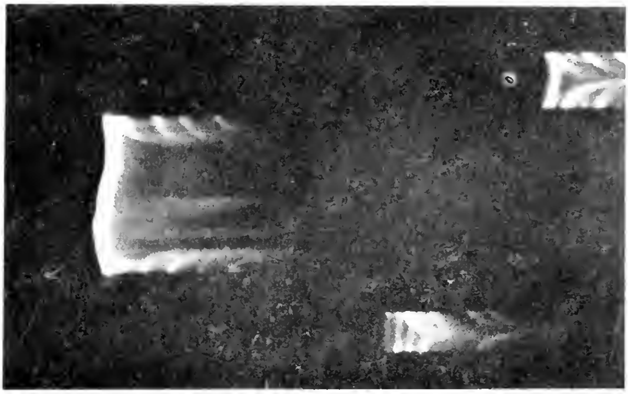


Fig. 9.—Photograph of a pilot spark, which is the principal factor in the method of wireless telegraphy.

the magnetic pulse or wave which is sent out from the spark, and which will cause a distant circuit to respond by a similar oscillation.

At present the shortest time that can, so to speak, be photographed in this manner is about one two-millionth of a second. This is the time of propagation of a magnetic wave over four hundred feet long. The waves used in wireless telegraphy are not more than four feet in length—about one hundredth the length of those we can photograph. The photographic method thus reveals a mechanism of the spark which is entirely hidden from the eye and will always be concealed from human sight. It reveals, however, a greater mystery which it seems incompetent to solve—the mystery of what is called the pilot spark, the first discharge which we see on our photograph (Fig. 9) stretching intact from terminal to terminal, having the prodigious velocity of one hundred and eighty thousand miles a second. None of our experimental devices suffice to penetrate the mystery of this discharge. It is this pilot spark which is chiefly instrumental in sending out the magnetic pulses or waves which are powerful enough to reach forty or fifty miles. The preponderating influence of this pilot spark—so called since it finds a way for the subsequent surgings

or oscillations—is a bar to the efforts to make wireless telegraphy secret. We can see from the photograph how much greater its strength is than that of the subsequent discharges shown by the mere brightening of the terminals. A delicate coherer will immediately respond to the influence of this pilot spark, and the subsequent oscillations of this discharge will have little effect. How, then, can we effectively time a receiving circuit so that it will respond to only one sending station? We can not depend upon the oscillatory nature of the spark, or adopt, in other words, its rate of vibration and form a coherer with the same rate.

It seems as if it would be necessary to invent some method of sending pilot sparks at a high and definite rate of vibration, and of employing coherers which will only respond to definite powerful rates of magnetic pulsation. Various attempts have been made to produce by mechanical means powerful electric surgings, but they have been unsuccessful. Both high electro-motive force and strength of current are needed. These can be obtained by the employment of a great number of storage cells. The discharge from a large number of these cells, however, is not suitable for the purpose of wireless telegraphy, although it may possess the qualifications of both high electrical pressure and strength of current.

The only apparatus we have at command to produce quick blows on the ether is the Ruhmkorf coil. This coil, I have said, has been in all our physical cabinets for fifty years. It contained within itself the germ of the telephone transmitter and the method of wireless telegraphy, unrecognized until the present. In its elements it consists, as we have seen, of two electrical circuits, placed near each other, entirely unconnected. A battery is connected with one of these circuits, and any change in the strength of the electrical current gives a blow to the ether or medium between the two circuits. A quick stopping of the electrical current gives the strongest impulse to the ether, which is taken up by the neighboring circuit. For the past fifty years very little advance has been made in the method of giving strong electrical impulses to the medium of space. It is accomplished simply by a mechanical breaking of the connection to the battery, either by a revolving wheel with suitable projections, or by a vibrating point. All the various forms of mechanical breaks are inefficient. They do not give quick and uniform breaks. Latterly, hopes have been excited by the discovery of a chemical break, called the Weynelt interrupter, shown in Fig. 1. The electrical current in passing through a vessel of diluted sulphuric acid from a point of platinum to a disk of lead causes bubbles of gas which form a barrier to its passage which is

suddenly broken down, and this action goes on at a high rate of speed, causing a torrent of sparks in the neighboring circuit. The medium between the two circuits is thereby submitted to rapid and comparatively powerful impulses. The discovery of this and similar chemical or molecular interruptions marks an era in the history of the electrical transformer, and the hopes of further progress by means of them is far greater than in the direction of mechanical interruptions.

We are still, however, unable to generate sufficiently powerful and sufficiently well-timed electrical impulses to make wireless telegraphy of great and extended use. Can we not hope to strengthen the present feeble impulses in wireless telegraphy by some method of relaying or repeating? In the analogous subject of telephony many efforts have also been made to render the service secret, and to extend it to great distances by means of relays. These efforts have not been successful up to the present. We still have our neighbors' call bells, and we could listen to their messages if we were gossips. The telephone service has been extended to great distances—for instance, from Boston to Omaha—not by relays, but by strengthening the blows upon the medium between the transmitting circuit and the receiving one, just as we desire to do in what is called wireless telegraphy, the apparatus of which is almost identical in principle to that employed in telephony. The individual call in telephony is not a success for nearly the same reasons that exist in the case of wireless telegraphy. Perfectly definite and powerful rates of vibration can not be sent from point to point over wires to which only certain definite apparatus will respond. There are so many ways in which the energy of the electric current can be dissipated in passing over wires and through calling bells that the form of the waves and their strength becomes attenuated. The form of the electrical waves is better preserved in free space, where there are no wires or where there is no magnetic matter. The difficulty in obtaining individual calls in wireless telegraphy resides in the present impossibility of obtaining sufficiently rapid and powerful electrical impulses, and a receiver which will properly respond to a definite number of such impulses.

The question of a relay seems as impossible of solution as it does in telephony. The character of speech depends upon numberless delicate inflections and harmonies. The form, for instance, of the wave transmitting the vowel *a* must be preserved in order that the sound may be recognized. A relay in telephony acts very much like one's neighbor in the game called gossip, in which a sentence repeated more or less indistinctly, after passing from one person to another, becomes distorted and meaningless. No

telephone relay has been invented which preserves the form of the first utterance, the vowel *a* loses its delicate characteristics, and becomes simply a meaningless noise. It is maintained by some authorities that such a relay can not be invented, that it is impossible to preserve the delicate inflections of the human voice in passing from one circuit to another, even through an infinitesimal air gap or ether space. It is well, however, to reflect upon Hosea Bigelow's sapient advice "not to prophesy unless you know." It was maintained in the early days of the telephone that speech would lose so many characteristics in the process of transmission over wires and through magnetic apparatus that it would not be intelligible. It is certain that at present long-distance transmission of speech can only be accomplished by using more powerful transmitters, and by making the line of copper better fitted for the transmission—just as quick transportation from place to place has not been accomplished by quitting the earth and by flying through space, but by obtaining more powerful engines and by improving the roadbeds.

The hopes of obtaining a relay for wireless telegraphy seem as small as they do in telephony. The present method is practically limited to distances of fifty or sixty miles—distances not much exceeding those which can be reached by a search-light in fair weather. Indeed, there is a close parallelism between the search-light and the spark used in Marconi's experiments: both send out waves which differ only in length. The waves of the search-light are about one forty-thousandth of an inch long, while the magnetic waves of the spark, invisible to the eye, are three to four feet—more than a million times longer than the light waves. These very long waves have this advantage over the short light waves: they are able to penetrate fog, and even sand hills and masonry. One can send messages into a building from a point outside. A prisoner could communicate with the outer world, a beleaguered garrison could send for help, a disabled light-ship could summon assistance, and possibly one steamer could inform another in a fog of its course.

Wireless telegraphy is the nearest approach to telepathy that has been vouchsafed to our intelligence, and it serves to stimulate our imagination and to make us think that things greatly hoped for can be always reached, although not exactly in the way expected. The nerves of the whole world are, so to speak, being bound together, so that a touch in one country is transmitted instantly to a far-distant one. Why should we not in time speak through the earth to the antipodes? If the magnetic waves can pass through brick and stone walls and sand hills, why should we

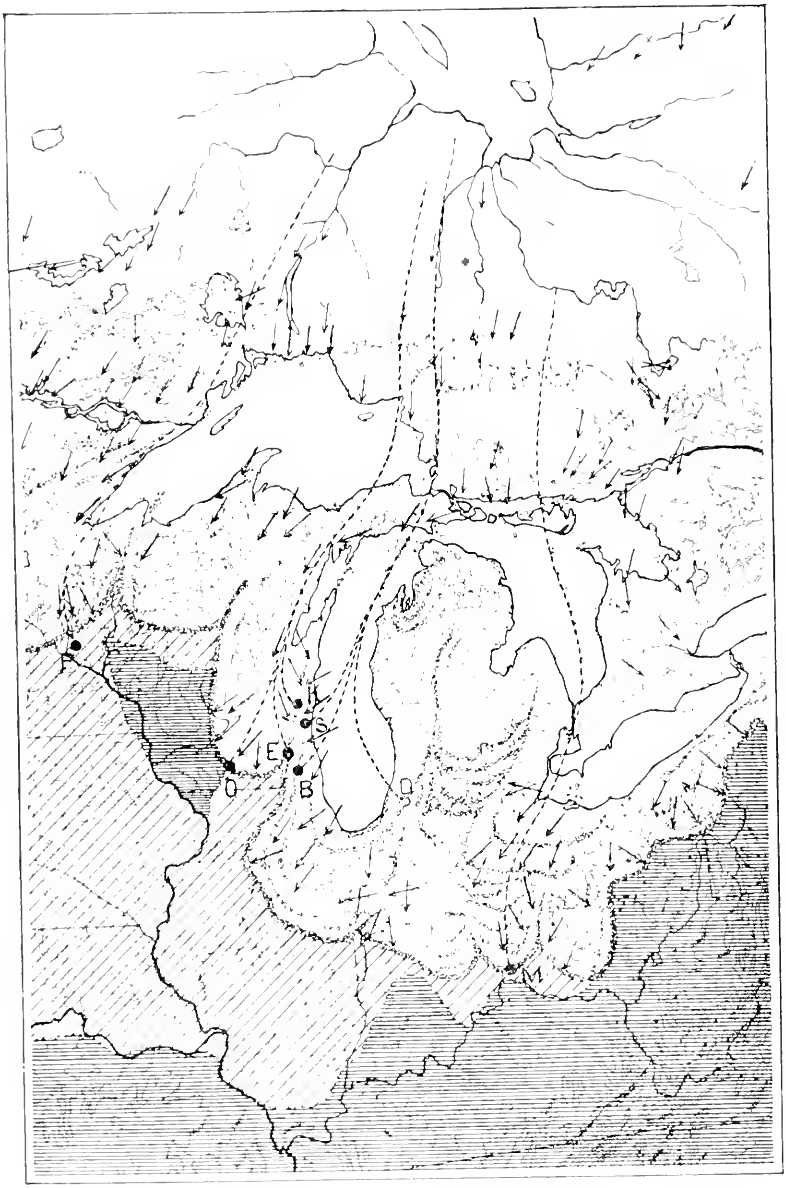
not direct, so to speak, our trumpet to the earth, instead of letting its utterances skim over the horizon? In regard to this suggestion, we know certainly one fact from our laboratory experiences: that these magnetic waves, meeting layers of electrically conducting matter, like layers of iron ore, would be reflected back, and would not penetrate. Thus a means may be discovered through the instrumentality of such waves of exploring the mysteries of the earth before success is attained in completely penetrating its mass.

EMIGRANT DIAMONDS IN AMERICA.

By Prof. WILLIAM HERBERT HOBBS.

TO discover the origin of the diamond in Nature we must seek it in its ancestral home, where the rocky matrix gave it birth in the form characteristic of its species. In prosecuting our search we should very soon discover that, in common with other gem minerals, the diamond has been a great wanderer, for it is usually found far from its original home. The disintegrating forces of the atmosphere, by acting upon the rocky material in which the stones were imbedded, have loosed them from their natural setting, to be caught up by the streams, sorted from their disintegrated matrix, and transported far from the parent rock, to be at last set down upon some gravelly bed over which the force of the current is weakened. The mines of Brazil and the Urals, of India, Borneo, and the "river diggings" of South Africa either have been or are now in deposits of this character.

The "dry diggings" of the Kimberley district, in South Africa, afford the unique locality in which the diamond has thus far been found in its original home, and all our knowledge of the genesis of the mineral has been derived from study of this locality. The mines are located in "pans," in which is found the "blue ground" now recognized as the disintegrated matrix of the diamond. These "pans" are known to be the "pipes," or "necks," of former volcanoes, now deeply dissected by the forces of the atmosphere—in fact, worn down if not to their roots, at least to their stumps. These remnants of the "pipes," through which the lava reached the surface, are surrounded in part by a black shale containing a large percentage of carbon, and this is believed to be the material out of which the diamonds have been formed. What appear to be modified fragments of the black shale inclosed within the "pipes" afford evidence that portions of the shale have been broken from the parent beds by the force of the ascending current of lava—a



GLACIAL MAP OF THE GREAT LAKES REGION

Driftless Areas — Older Drift — Newer Drift

Moraines — Glacial Striae — Track of Diamonds

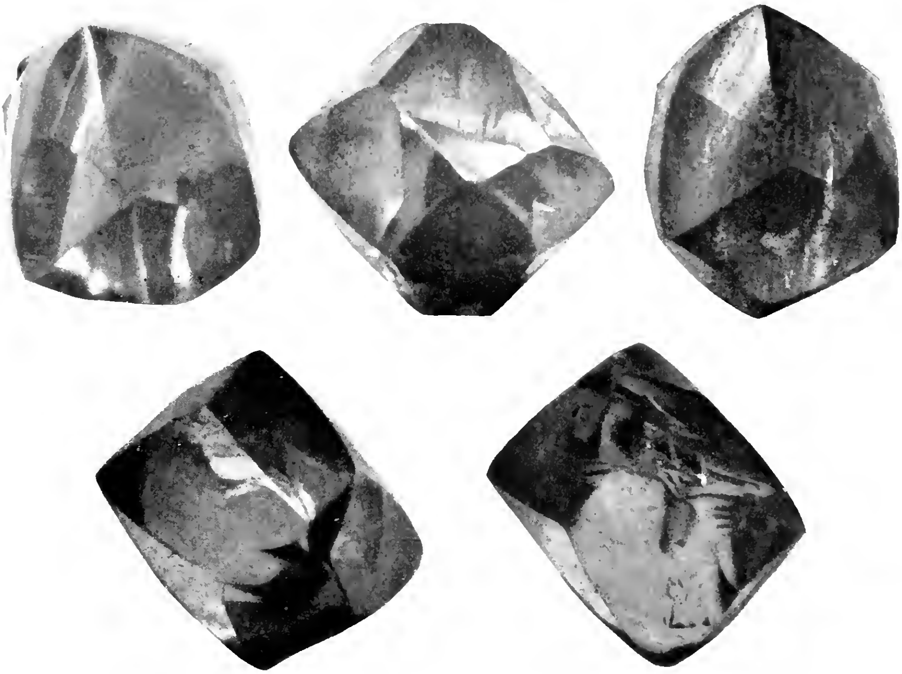
Diamond Localities — 0 — 100 — E. Eagle — O Oregon

K. Kohlsville — O. Dowagiac — M. Milford. P. Plum Crk. — B Burlington

We are indebted to the University of Chicago Press for the above illustration.

common enough accompaniment to volcanic action—and have been profoundly altered by the high temperature and the extreme hydrostatic pressure under which the mass must have been held. The most important feature of this alteration has been the recrystallization of the carbon of the shale into diamond.

This apparent explanation of the genesis of the diamond finds strong support in the experiments of Moissan, who obtained artificial diamond by dissolving carbon in molten iron and immersing the mass in cold water until a firm surface crust had formed. The



FIVE VIEWS OF THE EAGLE DIAMOND (sixteen carats); enlarged about three diameters. (Owned by Tiffany and Company.)

We are indebted to the courtesy of Mr. G. F. Kunz, of Tiffany and Company, for the illustrations of the Oregon and Eagle diamonds.

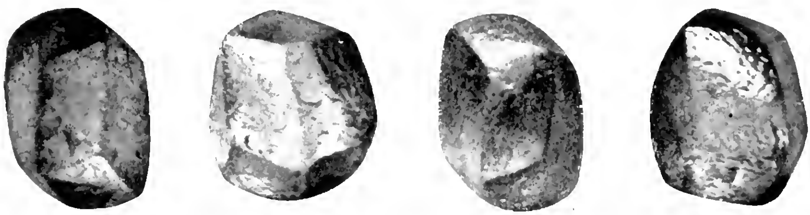
"chilled" mass was then removed, to allow its still molten core to solidify slowly. This it does with the development of enormous pressures, because the natural expansion of the iron on passing into the solid condition is resisted by the strong shell of "chilled" metal. The isolation of the diamond was then accomplished by dissolving the iron in acid.

The prevailing form of the South African diamonds is that of a rounded crystal, with eight large and a number of minute faces—a form called by crystallographers a *modified octahedron*. Their

shapes would be roughly simulated by the Pyramids of Egypt if they could be seen, combined with their reflected images, in a placid lake, or, better to meet the conditions of the country, in a desert mirage. It is a peculiar property of diamond crystals to have convexly rounded faces, so that the edges which separate the faces are not straight, but gently curving. Less frequently in the African mines, but commonly in some other regions, diamonds are bounded by four, twelve, twenty-four, or even forty-eight faces. These must not, of course, be confused with the faces of cut stones, which are the product of the lapidary's art.

Geological conditions remarkably like those observed at the Kimberley mines have recently been discovered in Kentucky, with the difference that here the shales contain a much smaller percentage of carbon, which may be the reason that diamonds have not rewarded the diligent search that has been made for them.

Though now found in the greatest abundance in South Africa and in Brazil, diamonds were formerly obtained from India, Bor-



Four Views of the Oregon Diamond; enlarged about three diameters. (Owned by Tiffany and Company.)

neo, and from the Ural Mountains of Russia. The great stones of history have, with hardly an exception, come from India, though in recent years a number of diamond monsters have been found in South Africa. One of these, the "Excelsior," weighed nine hundred and seventy carats, which is in excess even of the supposed weight of the "Great Mogul."

Occasionally diamonds have come to light in other regions than those specified. The Piedmont plateau, at the southeastern base of the Appalachians, has produced, in the region between southern Virginia and Georgia, some ten or twelve diamonds, which have varied in weight from those of two or three carats to the "Dewey" diamond, which when found weighed over twenty-three carats.

It is, however, in the territory about the Great Lakes that the greatest interest now centers, for in this region a very interesting problem of origin is being worked out. No less than seven diamonds, ranging in size from less than four to more than twenty-one carats, not to mention a number of smaller stones, have been

recently found in the clays and gravels of this region, where their distribution was such as to indicate with a degree of approximation the location of their distant ancestral home.

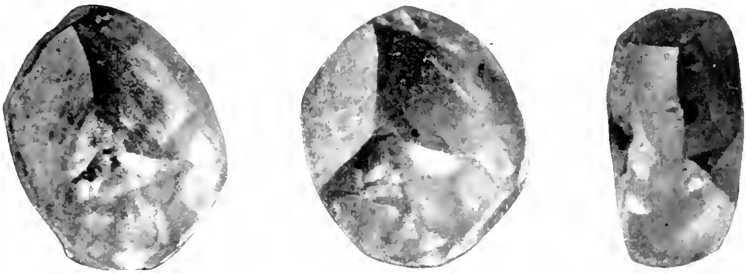
In order clearly to set forth the nature of this problem and the method of its solution it will be necessary, first, to plot upon a map of the lake region the locality at which each of the stones has been found, and, further, to enter upon the same map the data which geologists have gleaned regarding the work of the great ice cap of the Glacial period. During this period, not remote as geological time is reckoned, an ice mantle covered the entire north-eastern portion of our continent, and on more than one occasion it invaded for considerable distances the territory of the United States. Such a map as has been described discloses an important fact which holds the clew for the detection of the ancestral home of these diamonds. Each year is bringing with it new evidence, and we may look forward hopefully to a full solution of the problem.

In 1883 the "Eagle Stone" was brought to Milwaukee and sold for the nominal sum of one dollar. When it was submitted to competent examination the public learned that it was a diamond of sixteen carats' weight, and that it had been discovered seven years earlier in earth removed from a well-opening. Two events which were calculated to arouse local interest followed directly upon the discovery of the real nature of this gem, after which it passed out of the public notice. The woman who had parted with the gem for so inadequate a compensation brought suit against the jeweler to whom she had sold it, in order to recover its value. This curious litigation, which naturally aroused a great deal of interest, was finally carried to the Supreme Court of the State of Wisconsin, from which a decision was handed down in favor of the defendant, on the ground that he, no less than the plaintiff, had been ignorant of the value of the gem at the time of purchasing it. The other event was the "boom" of the town of Eagle as a diamond center, which, after the finding of two other diamonds with unmistakable marks of African origin upon them, ended as suddenly as it had begun, with the effect of temporarily discrediting, in the minds of geologists, the genuineness of the original "find."

Ten years later a white diamond of a little less than four carats' weight came to light in a collection of pebbles found in Oregon, Wisconsin, and brought to the writer for examination. The stones had been found by a farmer's lad while playing in a clay bank near his home. The investigation of the subject which was thereupon made brought out the fact that a third diamond, and this the largest

of all, had been discovered at Kohlsville, in the same State, in 1883, and was still in the possession of the family on whose property it had been found.

As these stones were found in the deposits of "drift" which were left by the ice of the Glacial period, it was clear that they had been brought to their resting places by the ice itself. The



Three Views of the Saukville Diamond (six carats); enlarged about three diameters. (Owned by Bunde and Upmeyer, Milwaukee.)

We are indebted to the courtesy of Bunde and Upmeyer, of Milwaukee, for the illustrations showing the Burlington and Saukville diamonds.

map reveals the additional fact, and one of the greatest significance, that all these diamonds were found in the so-called "kettle moraine." This moraine or ridge was the dumping ground of the ice for its burden of bowlders, gravel, and clay at the time of its later invasion, and hence indicates the boundaries of the territory over which the ice mass was then extended. In view of the fact that two of the three stones found had remained in the hands of the farming population, without coming to the knowledge of the world, for periods of eleven and seven years respectively, it seems most probable that others have been found, though not identified as diamonds, and for this reason are doubtless still to be found in many cases in association with other local "curios" on the clock shelves of country farmhouses in the vicinity of the "kettle moraine." The writer felt warranted in predicting, in 1894, that other diamonds would occasionally be brought to light in the "kettle moraine," though the great extent of this moraine left little room for hope that more than one or two would be found at any one point of it.

In the time that has since elapsed diamonds have been found at the rate of about one a year, though not, so far as I am aware, in any case as the result of search. In Wisconsin have been found the Saukville diamond, a beautiful white stone of six carats' weight, and also the Burlington stone, having a weight of a little over two carats. The former had been for more than sixteen years in the possession of the finder before he learned of its value. In Michi-

gan has been found the Dowagiac stone, of about eleven carats' weight, and only very recently a diamond weighing six carats and of exceptionally fine "water" has come to light at Milford, near Cincinnati. This augmentation of the number of localities, and the nearness of all to the "kettle moraines," leaves little room for doubt that the diamonds were conveyed by the ice at the time of its later invasion of the country.

Having, then, arrived at a satisfactory conclusion regarding not only the agent which conveyed the stones, but also respecting the period during which they were transported, it is pertinent to inquire by what paths they were brought to their adopted homes, and whether, if these may be definitely charted, it may not be possible to follow them in a direction the reverse of that taken by the diamonds themselves until we arrive at the point from which each diamond started upon its journey. If we succeed in this we shall learn whether they have a common home, or whether they were formed in regions more or less widely separated. From the great rarity of diamonds in Nature it would seem that the hypothesis of a common home is the more probable, and this view finds confirmation in the fact that certain marks of "consanguinity" have been observed upon the stones already found.

Not only did the ice mantle register its advance in the great ridge of morainic material which we know as the "kettle moraine," but it has engraved upon the ledges of rock over which it has ridden, in a simple language of lines and grooves, the direction of its

Four Views of the Burlington Diamond (a little over two carats); enlarged about three diameters. (Owned by Bunde and Upmeyer, Milwaukee.)

movement, after first having planed away the disintegrated portions of the rock to secure a smooth and lasting surface. As the same ledges have been overridden more than once, and at intervals widely separated, they are often found, palimpsestlike, with recent characters superimposed upon earlier, partly effaced, and nearly illegible ones. Many of the scattered leaves of this record have, however, been copied by geologists, and the autobiography of the ice is now read from maps which give the direction of its flow, and allow the motion of the ice as a whole, as well as that

of each of its parts, to be satisfactorily studied. Recent studies by Canadian geologists have shown that one of the highest summits of the ice cap must have been located some distance west of Hudson Bay, and that another, the one which glaciated the lake region, was in Labrador, to the east of the same body of water. From these points the ice moved in spreading fans both northward toward the Arctic Ocean and southward toward the States, and always approached the margins at the moraines in a direction at right angles to their extent. Thus the rock material transported by the ice was spread out in a great fan, which constantly extended its boundaries as it advanced.

The evidence from the Oregon, Eagle, and Kohlsville stones, which were located on the moraine of the Green Bay glacier, is that their home, in case they had a common one, is between the northeastern corner of the State of Wisconsin and the eastern summit of the ice mantle—a narrow strip of country of great extent,

Three Views of a Lead Cast of the Milford Stone (six carats); enlarged about three diameters.

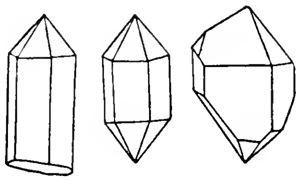
We are indebted to the courtesy of Prof. T. H. Norton, of the University of Cincinnati, for the above illustrations.

but yet a first approximation of the greatest value. If we assume, further, that the Saukville, Burlington, and Dowagiac stones, which were found on the moraine of the Lake Michigan glacier, have the same derivation, their common home may confidently be placed as far to the northeast as the wilderness beyond the Great Lakes, since the Green Bay and Lake Michigan glaciers coalesced in that region. The small stones found at Plum Creek, Wisconsin, and the Cincinnati stone, if the locations of their discovery be taken into consideration, still further circumscribe the diamond's home territory, since the lobes of the ice mass which transported them made a complete junction with the Green Bay and Lake Michigan lobes or glaciers considerably farther to the northward than the point of union of the latter glaciers themselves.

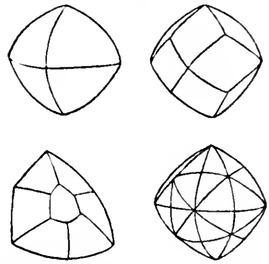
If, therefore, it is assumed that all the stones which have been found have a common origin, the conclusion is inevitable that the ancestral home must be in the wilderness of Canada between the

points where the several tracks marking their migrations converge upon one another, and the former summit of the ice sheet. The broader the "fan" of their distribution, the nearer to the latter must the point be located.

It is by no means improbable that when the barren territory about Hudson Bay is thoroughly explored a region for profitable



Common Forms of Quartz Crystals.



Common Forms of Diamonds. The African stones most resemble the figure above at the left (octahedron). The Wisconsin stones most resemble the figure above at the right (dodecahedron).

diamond mining may be revealed, but in the meantime we may be sure that individual stones will occasionally be found in the new American homes into which they were imported long before the days of tariffs and ports of entry. Mother Nature, not content with lavishing upon our favored nation the boundless treasures locked up in her mountains, has robbed the territory of our Canadian cousins of the rich soils which she has unloaded upon our lake States, and of the diamonds with which she has sowed them.

The range of the present distribution of the diamonds, while perhaps not limited exclusively to the "kettle moraine," will, as the events have indicated, be in the main confined to it. This moraine, with its numerous subordinate ranges marking halting places in the final retreat of the ice, has now been located with sufficient accuracy by the geologists of the United States Geological Survey and others, approximately as entered upon the accompanying map. Within the territory of the United States the large number of observations of the rock scorings makes it clear that the ice of each lobe or glacier moved from the central portion toward the marginal moraines, which are here indicated by dotted bands. In the wilderness of Canada the observations have been rare, but the few data which have been gleaned are there represented by arrows pointed in the direction of ice movement.

There is every encouragement for persons who reside in or near the marginal moraines to search in them for the scattered jewels, which may be easily identified and which have a large commercial as well as scientific value.

The Wisconsin Geological and Natural History Survey is now interesting itself in the problem of the diamonds, and has undertaken the task of disseminating information bearing on the subject to the people who reside near the "kettle moraine." With the co-operation of a number of mineralogists who reside near this "diamond belt," it offers to make examination of the supposed gem stones which may be collected.

The success of this undertaking will depend upon securing the co-operation of the people of the morainal belt. Wherever gravel ridges have there been opened in cuts it would be advisable to look for diamonds. Children in particular, because of their keen eyes and abundant leisure, should be encouraged to search for the clear stones.

The serious defect in this plan is that it trusts to inexperienced persons to discover the buried diamonds which in the "rough" are probably unlike anything that they have ever seen. The first result of the search has been the collection of large numbers of quartz pebbles, which are everywhere present but which are entirely valueless. There are, however, some simple ways of distinguishing diamonds from quartz.

Diamonds never appear in thoroughly rounded forms like ordinary pebbles, for they are too hard to be in the least degree worn by contact with their neighbors in the gravel bed. Diamonds always show, moreover, distinct forms of crystals, and these generally bear some resemblance to one of the forms figured. They are never in the least degree like crystals of quartz, which are, however, the ones most frequently confounded with them. Most of the Wisconsin diamonds have either twelve or forty-eight faces. Crystals of most minerals are bounded by plane surfaces—that is to say, their faces are flat—the diamond, however, is inclosed by distinctly curving surfaces.

The one property of the diamond, however, which makes it easy of determination is its extraordinary hardness—greater than that of any other mineral. Put in simple language, the hardness of a substance may be described as its power to scratch other substances when drawn across them under pressure. To compare the hardness of two substances we should draw a sharp point of one across a surface of the other under a pressure of the fingers, and note whether a permanent scratch is left. The harder substances will always scratch the softer, and if both have the same hardness they may be made to mutually scratch each other. Since diamond, sapphire, and ruby are the only minerals which are harder than emery they are the only ones which, when drawn across a rough emery surface, will not receive a scratch. Any stone which

will not take a scratch from emery is a gem stone and of sufficient interest to be referred to a competent mineralogist.

The dissemination of information regarding the lake diamonds through the region of the moraine should serve the twofold purpose of encouraging search for the buried stones and of discovering diamonds in the little collections of "lucky stones" and local curios which accumulate on the clock shelves of country farmhouses. When it is considered that three of the largest diamonds thus far found in the region remained for periods of seven, eight, and sixteen years respectively in the hands of the farming population, it can hardly be doubted that many other diamonds have been found and preserved as local curiosities without their real nature being discovered.

If diamonds should be discovered in the moraines of eastern Ohio, of western Pennsylvania, or of western New York, considerable light would thereby be thrown upon the problem of locating the ancestral home. More important than this, however, is the mapping of the Canadian wilderness to the southeastward and eastward of James Bay, in order to determine the direction of ice movement within the region, so that the *tracking* of the stones already found may be carried nearer their home. The Director of the Geological Survey of Canada is giving attention to this matter, and has also suggested that a study be made of the material found in association with the diamonds in the moraine, so that if possible its source may be discovered.

With the discovery of new localities of these emigrant stones and the collection of data regarding the movement of the ice over Canadian territory, it will perhaps be possible the more accurately and definitely to circumscribe their home country, and as its boundaries are drawn closer and closer to pay this popular jewel a visit in its ancestral home, there to learn what we so much desire to know regarding its genesis and its life history.

William Pengelly related, in one of his letters to his wife from the British Association, Oxford meeting, 1860, of Sedgwick's presidency of the Geological Section, that his opening address was "most characteristic, full of clever fun, most imperative that papers should be as brief as possible —about ten minutes, he thought—he himself amplifying marvelously." The next day Pengelly himself was about to read his paper, when "dear old Sedgwick wished it compressed. I replied that I would do what I could to please him, but did not know which to follow, his precept or example. The roar of laughter was deafening. Old Sedgwick took it capitally, and behaved much better in consequence." On the third day Pengelly went to committee, where, he says, "I found Sedgwick very cordial, took my address, and talks of paying me a visit."

NEEDED IMPROVEMENTS IN THEATER SANITATION.

By WILLIAM PAUL GERHARD, C. E.,
CONSULTING ENGINEER FOR SANITARY WORKS.

BUILDINGS for the representation of theatrical plays must fulfill three conditions: they must be (1) comfortable, (2) safe, and (3) healthful. The last requirement, of *healthfulness*, embraces the following conditions: plenty of pure air, freedom from draughts, moderate warming in winter, suitable cooling in summer, freedom at all times from dust, bad odors, and disease germs. In addition to the requirements for the theater audience, due regard should be paid to the comfort, healthfulness, and safety of the performers, stage hands, and mechanics, who are required to spend more hours in the stage part of the building than the playgoers.

It is no exaggeration to state that in the majority of theater buildings disgracefully unsanitary conditions prevail. In the older existing buildings especially sanitation and ventilation are sadly neglected. The air of many theaters during a performance becomes overheated and stuffy, pre-eminently so in the case of theaters where illumination is effected by means of gaslights. At the end of a long performance the air is often almost unbearably foul, causing headache, nausea, and dizziness.

In ill-ventilated theaters a chilly air often blows into the auditorium from the stage when the curtain is raised. This air movement is the cause of colds to many persons in the audience, and it is otherwise objectionable, for it carries with it noxious odors from the stage or under stage, and in gas-lighted theaters this air is laden with products of combustion from the footlights and other means of stage illumination.

Attempts at ventilation are made by utilizing the heat due to the numerous flames of the central chandelier over the auditorium, to create an ascending draught, and thereby cause a removal of the contaminated air, but seldom is provision made for the introduction of fresh air from outdoors, hence the scheme of ventilation results in failure. In other buildings, openings for the introduction of pure air are provided under the seats or in the floor, but are often found stuffed up with paper because the audience suffered from draughts. The fear of draughts in a theater also leads to the closing of the few possibly available outside windows and doors. The plan of a theater building renders it almost impossible to provide outside windows, therefore "air flushing" during the day can not be practiced. In the case of the older theaters, which are

located in the midst or rear of other buildings, the nature of the site precludes a good arrangement of the main fresh-air ducts for the auditorium.

Absence of fresh air is not the only sanitary defect of theater buildings; there are many other defects and sources of air pollution. In the parts devoted to the audience, the carpeted floors become saturated with dirt and dust carried in by the playgoers, and with expectorations from careless or untidy persons which in a mixed theater audience are ever present. The dust likewise adheres to furniture, plush seats, hangings, and decorations, and intermingled with it are numerous minute floating organisms, and doubtless some germs of disease.

Behind the curtain a general lack of cleanliness exists—untidy actors' toilet rooms, ill-drained cellars, defective sewerage, leaky drains, foul water closets, and overcrowded and poorly located dressing rooms into which no fresh air ever enters. The stage floor is covered with dust; this is stirred up by the frequent scene shifting or by the dancing of performers, and much of it is absorbed and retained by the canvas scenery.

Under such conditions the state of health of both theater goers and performers is bound to suffer. Many persons can testify from personal experience to the ill effects incurred by spending a few hours in a crowded and unventilated theater; yet the very fact that the stay in such buildings is a brief one seems to render most people indifferent, and complaints are seldom uttered. It really rests with the theater-going public to enforce the much-needed improvements. As long as they will flock to a theater on account of some attractive play or "star actor," disregarding entirely the unsanitary condition of the building, so long will the present notoriously bad conditions remain. When the public does not call for reforms, theater managers and owners of playhouses will not, as a rule, trouble themselves about the matter. We have a right to demand theater buildings with less outward and inside gorgeousness, but in which the paramount subjects of comfort, safety, and health are diligently studied and generously provided for. Let the general public but once show a determined preference for sanitary conditions and surroundings in theaters and abandon visits to ill-kept theaters, and I venture to predict that the necessary reforms in sanitation will soon be introduced, at least in the better class of playhouses. In the cheaper theaters, concert and amusement halls, houses with "continuous" shows, variety theaters, etc., sanitation is even more urgently required, and may be readily enforced by a few visits and peremptory orders from the Health Board.

When, a year ago, the writer, in a paper on Theater Sanitation presented at the annual meeting of the American Public Health Association, stated that "chemical analyses show the air in the dress circle and gallery of many a theater to be in the evening more foul than the air of street sewers," the statement was received by some of his critics with incredulity. Yet the fact is true of many theaters. Taking the amount of carbonic acid in the air as an indication of its contamination, and assuming that the organic vapors are in proportion to the amount of carbonic acid (not including the CO_2 due to the products of illumination), we know that normal outdoor air contains from 0.03 to 0.04 parts of CO_2 per 100 parts of air, while a few chemical analyses of the air in English theaters, quoted below, suffice to prove how large the contamination sometimes is:

Strand Theater, 10 P. M., gallery	0.101	parts	CO_2	per 100.
Surrey Theater, 10 P. M., boxes	0.111	"	"	"
Surrey Theater, 12 P. M., boxes	0.218	"	"	"
Olympia Theater, 11.30 P. M., boxes	0.082	"	"	"
Olympia Theater, 11.55 P. M., boxes	0.101	"	"	"
Victoria Theater, 10 P. M., boxes	0.126	"	"	"
Haymarket Theater, 11.30 P. M., dress circle	0.076	"	"	"
City of London Theater, 11.15 P. M., pit	0.252	"	"	"
Standard Theater, 11 P. M., pit	0.320	"	"	"
Theater Royal, Manchester, pit	0.2734	"	"	"
Grand Theater, Leeds, pit	0.150	"	"	"
Grand Theater, Leeds, upper circle	0.143	"	"	"
Grand Theater, balcony	0.142	"	"	"
Prince's Theater, Manchester	0.11–0.17	"	"	"

(Analyses made by Drs. Smith, Bernays, and De Chaumont.)

Compare with these figures some analyses of the air of sewers. Dr. Russell, of Glasgow, found the air of a well-ventilated and flushed sewer to contain 0.051 vols. of CO_2. The late Prof. W. Ripley Nichols conducted many careful experiments on the amount of carbonic acid in the Boston sewers, and found the following averages, viz., 0.087, 0.082, 0.115, 0.107, 0,08, or much less than the above analyses of theater air showed. He states: "It appears from these examinations that the air even in a tide-locked sewer does not differ from the standard as much as many no doubt suppose."

A comparison of the number of bacteria found in a cubic foot of air inside of a theater and in the street air would form a more convincing statement, but I have been unable to find published records of any such bacteriological tests. Nevertheless, we know that while the atmosphere contains some bacteria, the indoor air of crowded assembly halls, laden with floating dust, is particularly

rich in living micro-organisms. This has been proved by Tyndall, Miquel, Frankland, and other scientists; and in this connection should be mentioned one point of much importance, ascertained quite recently, namely, that the air of sewers, contrary to expectation, is remarkably free from germs. An analysis of the air in the sewers under the Houses of Parliament, London, showed that the number of micro-organisms was much less than that in the atmosphere outside of the building.

In recent years marked improvements in theater planning and equipment have been effected, and corresponding steps in advance have been made in matters relating to theater hygiene. It should therefore be understood that my remarks are intended to apply to the average theater, and in particular to the older buildings of this class. There are in large cities a few well-ventilated and hygienically improved theaters and opera houses, in which the requirements of sanitation are observed. Later on, when speaking more in detail of theater ventilation, instances of well-ventilated theaters will be mentioned. Nevertheless, the need of urgent and radical measures for comfort and health in the majority of theaters is obvious. Much is being done in our enlightened age to improve the sanitary condition of school buildings, jails and prisons, hospitals and dwelling houses. Why, I ask, should not our theaters receive some consideration?

The efficient ventilation of a theater building is conceded to be an unusually difficult problem. In order to ventilate a theater properly, the causes of noxious odors arising from bad plumbing or defective drainage should be removed; outside fumes or vapors must not be permitted to enter the building either through doors or windows, or through the fresh-air duct of the heating apparatus. The substitution of electric lights in place of gas is a great help toward securing pure air. This being accomplished, a standard of purity of the air should be maintained by proper ventilation. This includes both the removal of the vitiated air and the introduction of pure air from outdoors and the consequent entire change of the air of a hall three or four times per hour. The fresh air brought into the building must be ample in volume; it should be free from contamination, dust and germs (particularly pathogenic microbes), and with this in view must in cities be first purified by filtering, spraying, or washing. It should be warmed in cold weather by passing over hot-water or steam-pipe stacks, and cooled in warm weather by means of ice or the brine of mechanical refrigerating machines. The air should be of a proper degree of humidity, and, what is most important of all, it should be admitted into the various parts of the theater imperceptibly, so as not to cause the sensation of

draught; in other words, its velocity at the inlets must be very slight. The fresh air should enter the audience hall at numerous points so well and evenly distributed that the air will be equally diffused throughout the entire horizontal cross-section of the hall. The air indoors should have as nearly as possible the composition of air outdoors, an increase of the CO_2 from 0.3 to 0.6 being the permissible limit. The vitiated air should be continuously removed by mechanical means, taking care, however, not to remove a larger volume of air than is introduced from outdoors.

Regarding the amount of fresh outdoor air to be supplied to keep the inside atmosphere at anything like standard purity, authorities differ somewhat. The theoretical amount, 3,000 cubic feet per person per hour (50 cubic feet per minute), is made a requirement in the Boston theater law. In Austria, the law calls for 1,050 cubic feet. The regulations of the Prussian Minister of Public Works call for 700 cubic feet, Professor von Pettenkofer suggests an air supply per person of from 1,410 to 1,675 cubic feet per hour (23 to 28 cubic feet per minute), General Morin calls for 1,200 to 1,500 cubic feet, and Dr. Billings, an American authority, requires 30 cubic feet per minute, or 1,800 cubic feet per hour. In the Vienna Opera House, which is described as one of the best-ventilated theaters in the world, the air supply is 15 cubic feet per person per minute. The Madison Square Theater, in New York, is stated to have an air supply of 25 cubic feet per person.

In a moderately large theater, seating twelve hundred persons, the total hourly quantity of air to be supplied would, accordingly, amount to from 1,440,000 to 2,160,000 cubic feet. It is not an easy matter to arrange the fresh-air conduits of a size sufficient to furnish this volume of air; it is obviously costly to warm such a large quantity of air, and it is a still more difficult problem to introduce it without creating objectionable currents of air; and, finally, inasmuch as this air can not enter the auditorium unless a like amount of vitiated air is removed, the problem includes providing artificial means for the removal of large air volumes.

Where gas illumination is used, each gas flame requires an additional air supply—from 140 to 280 cubic feet, according to General Morin.

A slight consideration of the volumes of air which must be moved and removed in a theater to secure a complete change of air three or four times an hour, demonstrates the impossibility of securing satisfactory results by the so-called natural method of ventilation—i. e., the removal of air by means of flues with currents due either to the aspirating force of the wind or due to artificially

increased temperature in the flues. It becomes necessary to adopt mechanical means of ventilation by using either exhaust fans or pressure blowers or both, these being driven either by steam engines or by electric motors. In the older theaters, which were lighted by gas, the heat of the flames could be utilized to a certain extent in creating ascending currents in outlet shafts, and this accomplished some air renewal. But nowadays the central chandelier is almost entirely dispensed with; glowing carbon lamps, fed by electric currents, replace the gas flames; hence mechanical ventilation seems all the more indicated.

Two principal methods of theater ventilation may be arranged: in one the fresh air enters at or near the floor and rises upward to the ceiling, to be removed by suitable outlet flues; in this method the incoming air follows the naturally existing air currents; in the other method pure air enters at the top through perforated cornices or holes in the ceiling, and gradually descends, to be removed by outlets located at or near the floor line. The two systems are known as the "upward" and the "downward" systems; each of them has been successfully tried, each offers some advantages, and each has its advocates. In both systems separate means for supplying fresh air to the boxes, balconies, and galleries are required. Owing to the different opinions held by architects and engineers, the two systems have often been made the subject of inquiry by scientific and government commissions in France, England, Germany, and the United States.

A French scientist, Darcet, was the first to suggest a scientific system of theater ventilation. He made use of the heat from the central chandelier for removing the foul air, and admitted the air through numerous openings in the floor and through inlets in the front of the boxes.

Dr. Reid, an English specialist in ventilation, is generally regarded as the originator of the upward method in ventilation. He applied the same with some success to the ventilation of the Houses of Parliament in London. Here fresh air is drawn in from high towers, and is conducted to the basement, where it is sprayed and moistened. A part of the air is warmed by hot-water coils in a sub-basement, while part remains cold. The warm and the cold air are mixed in special mixing chambers. From here the tempered air goes to a chamber located directly under the floor of the auditorium, and passes into the hall at the floor level through numerous small holes in the floor. The air enters with low velocity, and to prevent unpleasant draughts the floor is covered in one hall with hair carpet and in the other with coarse hemp matting, both of which are cleaned every day. The removal of the foul

air takes place at the ceiling, and is assisted by the heat from the gas flames.

The French engineer Péclet, an authority on heating and ventilation, suggested a similar system of upward ventilation, but instead of allowing the foul air to pass out through the roof, he conducted it downward into an underground channel which had exhaust draught. Trélat, another French engineer, followed practically the same method.

A large number of theaters are ventilated on the upward system. I will mention first the large Vienna Opera House, the ventilation of which was planned by Dr. Boehm. The auditorium holds about three thousand persons, and a fresh-air supply of about fifteen cubic feet per minute, or from nine hundred to one thousand cubic feet per hour, per person is provided. The fresh air is taken in from the gardens surrounding the theater and is conducted into the cellar, where it passes through a water spray, which removes the dust and cools the air in summer. A suction fan ten feet in diameter is provided, which blows the air through a conduit forty-five square feet in area into a series of three chambers located vertically over each other under the auditorium. The lowest of these chambers is the cold-air chamber; the middle one is the heating chamber and contains steam-heating stacks; the highest chamber is the mixing chamber. The air goes partly to the heating and partly to the mixing chamber; from this it enters the auditorium at the rate of one foot per second velocity through openings in the risers of the seats in the parquet, and also through vertical wall channels to the boxes and upper galleries. The total area of the fresh-air openings is 750 square feet. The foul air ascends, assisted by the heat of the central chandelier, and is collected into a large exhaust tube. The foul air from the gallery passes out through separate channels. In the roof over the auditorium there is a fan which expels the entire foul air. Telegraphic thermometers are placed in all parts of the house and communicate with the inspection room, where the engineer in charge of the ventilation controls and regulates the temperature.

The Vienna Hofburg Theater was ventilated on the same system.

The new Frankfort Opera House has a ventilation system modeled upon that of the Vienna Opera House, but with improvements in some details. The house has a capacity of two thousand people, and for each person fourteen hundred cubic feet of fresh air per hour are supplied. A fan about ten feet in diameter and making ninety to one hundred revolutions per minute brings in the fresh air from outdoors and drives it into chambers under the

auditorium arranged very much like those at Vienna. The total quantity of fresh air supplied per hour is 2,800,000 cubic feet. The air enters the auditorium through gratings fixed above the floor level in the risers. The foul air is removed by outlets in the ceilings, which unite into a large vertical shaft below the cupola. An exhaust fan of ten feet diameter is placed in the cupola shaft, and is used for summer ventilation only. Every single box and stall is ventilated separately. The cost of the entire system was about one hundred and twenty-five thousand dollars; it requires a staff of two engineers, six assistant engineers, and a number of stokers.

Among well-ventilated American theaters is the Madison Square Theater (now Hoyt's), in New York. Here the fresh air is taken down through a large vertical shaft on the side of the stage. There is a seven-foot suction fan in the basement which drives the air into a number of boxes with steam-heating stacks, from which smaller pipes lead to openings under each row of seats. The foul air escapes through openings in the ceiling and under the galleries. A fresh-air supply of 1,500 cubic feet per hour, or 25 cubic feet per minute, per person is provided.

The Metropolitan Opera House is ventilated on the plenum system, and has an upward movement of air, the total air supply being 70,000 cubic feet per hour.

In the Academy of Music, Baltimore, the fresh air is admitted mainly from the stage and the exits of foul air are in the ceiling at the auditorium.

Other theaters ventilated by the upward method are the Dresden Royal Theater, the Lessing Theater in Berlin, the Opera House in Buda-Pesth, the new theater in Prague, the new Municipal Theater at Halle, and the Criterion Theatre in London.

The French engineer General Arthur Morin is known as the principal advocate of the downward method of ventilation. This was at that time a radical departure from existing methods because it apparently conflicted with the well-known fact that heated air naturally rises. Much the same system was advocated by Dr. Tripier in a pamphlet published in 1864.* The earlier practical applications of this system to several French theaters did not prove as much of a success as anticipated, the failure being due probably to the gas illumination, the central chandelier, and the absence of mechanical means for inducing a downward movement of the air.

In 1861 a French commission, of which General Morin was a member, proposed the reversing of the currents of air by admitting fresh air at both sides of the stage opening high up in the auditorium, and also through hollow floor channels for the balconies

* Dr. A. Tripier. Assainissement des Théâtres, Ventilation, Éclairage et Chauffage.

and boxes; in the gallery the openings for fresh air were located in the risers of the steppings. The air was exhausted by numerous openings under the seats in the parquet. This ventilating system was carried out at the Théâtre Lyrique, the Théâtre du Cirque, and the Théâtre de la Gaieté.

Dr. Tripier ventilated a theater in 1858 with good success on a similar plan, but he introduced the air partly at the rear of the stage and partly in the tympanum in the auditorium. He removed the foul air at the floor level and separately in the rear of the boxes. He also exhausted the foul air from the upper galleries by special flues heated by the gas chandelier.

The Grand Amphitheater of the Conservatory of Arts and Industries, in Paris, was ventilated by General Morin on the downward system. The openings in the ceiling for the admission of fresh air aggregated 120 square feet, and the air entered with a velocity of only eighteen inches per second; the total air supply per hour was 630,000 cubic feet. The foul air was exhausted by openings in steps around the vertical walls, and the velocity of the outgoing air was about two and a half feet per second.

The introduction of the electric light in place of gas gave a fresh impetus to the downward method of ventilation, and mechanical means also helped to dispel the former difficulties in securing a positive downward movement.

The Chicago Auditorium is ventilated on this system, a part of the air entering from the rear of the stage, the other from the ceiling of the auditorium downward. This plan coincides with the proposition made in 1846 by Morrill Wyman, though he admits that it can not be considered the most desirable method.

A good example of the downward method is given by the New York Music Hall, which has a seating capacity of three thousand persons and standing room for one thousand more. Fresh air at any temperature desired is made to enter through perforations in or near the ceilings, the outlets being concealed by the decorations, and passes out through exhaust registers near the floor line, under the seats, through perforated risers in the terraced steps. About 10,000,000 cubic feet of air are supplied per hour, and the velocity of influx and efflux is one foot per second. The air supplied per person per hour is figured at 2,700 cubic feet, and the entire volume is changed from four and a half to five times per hour. The fresh air is taken in at roof level through a shaft of seventy square feet area. The air is heated by steam coils, and cooled in summer by ice. The mechanical plant comprises four blowers and three exhaust fans of six and seven feet in diameter.

The downward method of ventilation was suggested in 1884

for the improvement of the ventilation of the Senate chamber and the chamber of the House of Representatives in the Capitol at Washington, but the system was not adopted by the Board of Engineers appointed to inquire into the methods.

The downward method is also used in the Hall of the Trocadéro, Paris; in the old and also the new buildings for the German Parliament, Berlin; in the Chamber of Deputies, Paris; and others.

Professor Fischer, a modern German authority on heating and ventilation, in a discussion of the relative advantages of the two methods, reaches the conclusion that both are practical and can be made to work successfully. For audience halls lighted by gaslights he considers the upward method as preferable.

In arranging for the removal of foul air it is necessary, particularly in the downward system, to provide separate exhaust flues for the galleries and balconies. Unless this is provided for, the exhaled air of the occupants of the higher tiers would mingle with the descending current of pure air supplied to the occupants of the main auditorium floor.

Mention should also be made of a proposition originating in Berlin to construct the roof of auditoriums domelike, by dividing it in the middle so that it can be partly opened by means of electric or hydraulic machinery; such a system would permit of keeping the ceiling open in summer time, thereby rendering the theater not only airy, but also free from the danger of smoke. A system based on similar principles is in actual use at the Madison Square Garden, in New York, where part of the roof consists of sliding skylights which in summer time can be made to open or close during the performance.

From the point of view of safety in case of fire, which usually in a theater breaks out on the stage, it is without doubt best to have the air currents travel in a direction from the auditorium toward the stage roof. This has been successfully arranged in some of the later Vienna theaters, but from the point of view of good acoustics, it is better to have the air currents travel from the stage toward the auditorium. Obviously, it is a somewhat difficult matter to reconcile the conflicting requirements of safety from smoke and fire gases, good acoustics and perfect ventilation.

The stage of a theater requires to be well ventilated, for often it becomes filled with smoke or gases due to firing of guns, colored lights, torches, representations of battles, etc. There should be in the roof over the stage large outlet flues, or sliding skylights, controlled from the stage for the removal of the smoke. These, in case of an outbreak of fire on the stage, become of vital impor-

tance in preventing the smoke and fire gases from being drawn into the auditorium and suffocating the persons in the gallery seats.

Where the stage is lit with gaslights it is important to provide a separate downward ventilation for the footlights. This, I believe, was first successfully tried at the large Scala Theater, of Milan, Italy.

The actors' and supers' dressing rooms, which are often overcrowded, require efficient ventilation, and other parts of the building, like the foyers and the toilet, retiring and smoking rooms, must not be overlooked.

The entrance halls, vestibules, lobbies, staircases, and corridors do not need so much ventilation, but should be kept warm to prevent annoying draughts. They are usually heated by abundantly large direct steam or hot-water radiators, whereas the auditorium and foyers, and often the stage, are heated by indirect radiation. Owing to the fact that during a performance the temperature in the auditorium is quickly raised by contact of the warm fresh air with the bodies of persons (and by the numerous lights, when gas is used), the temperature of the incoming air should be only moderate. In the best modern theater-heating plants it is usual to gradually reduce the temperature of the air as it issues from the mixing chambers toward the end of the performance. Both the temperature and the hygrometric conditions of the air should be controlled by an efficient staff of intelligent heating engineers.

But little need be said regarding theater lighting. Twice during the present century have the system and methods been changed. In the early part of the present century theaters were still lighted with tallow candles or with oil lamps. Next came what was at the time considered a wonderful improvement, namely, the introduction of gaslighting. The generation who can remember witnessing a theater performance by candle or lamp lights, and who experienced the excitement created when the first theater was lit up by gas, will soon have passed away. Scarcely twenty years ago the electric light was introduced, and there are to-day very few theaters which do not make use of this improved illuminant. It generates much less heat than gaslight, and vastly simplifies the problem of ventilation. The noxious products of combustion, incident to all other methods of illumination, are eliminated: no carbonic-acid gas is generated to render the air of audience halls irrespirable, and no oxygen is drawn to support combustion from the air introduced for breathing.

It being now an established fact that the electric light in-

creases the safety of human life in theaters and other places of amusement, its use is in many city or building ordinances made imperative—at least on the stage and in the main body of the auditorium. Stairs, corridors, entrances, etc., may, as a matter of precaution, be lighted by a different system, by means of either gas or auxiliary vegetable oil or candle lamps, protected by glass inclosures against smoke or draught, and provided with special inlet and outlet flues for air.

Passing to other desirable internal improvements of theaters, I would mention first the floors of the auditorium. The covering of the floor by carpets is objectionable—in theaters more so even than in dwelling houses. Night after night the carpet comes in contact with thousands of feet, which necessarily bring in a good deal of street dirt and dust. The latter falls on the carpets and attaches to them, and as it is not feasible to take the carpets up except during the summer closing, a vast accumulation of dirt and organic matter results, some of the dirt falling through the crevices between the floor boards. Many theater-goers are not tidy in their habits regarding expectoration, and as there must be in every large audience some persons afflicted with tuberculosis, the danger is ever present of the germs of the disease drying on the carpet, and becoming again detached to float in the air which we are obliged to breathe in a theater.

As a remedy I would propose abolishing carpets entirely, and using instead a floor covering of linoleum, or thin polished parquetry oak floors, varnished floors of hard wood, painted and stained floors, interlocked rubber-tile floors, or, at least for the aisles, encaustic or mosaic tiling. Between the rows of seats, as well as in the aisles, long rugs or mattings may be laid down loose, for these can be taken up without much trouble. They should be frequently shaken, beaten, and cleaned.

Regarding the walls, ceilings, and cornices, the surfaces should be of a material which can be readily cleaned and which is non-absorbent. Stucco finish is unobjectionable, but should be kept flat, so as not to offer dust-catching projections. Oil painting of walls is preferable to a covering with rough wall papers, which hold large quantities of dust. The so-called "sanitary" or varnished wall papers have a smooth, non-absorbent, easily cleaned surface, and are therefore unobjectionable. All heavy decorations, draperies, and hangings in the boxes, and plush covers for railings, are to be avoided.

The theater furniture should be of a material which does not catch or hold dust. Upholstered plush-covered chairs and seats retain a large amount of it, and are not readily cleaned. Leather-

covered or other sanitary furniture, or rattan seats, would be a great improvement.

In the stage building we often find four or five actors placed in one small, overheated, unventilated dressing room, located in the basement of the building, without outside windows, and fitted with three or four gas jets, for actors require a good light in "making up." More attention should be paid to the comfort and health of the players, more space and a better location should be given to their rooms. Every dressing room should have a window to the outer air, also a special ventilating flue. Properly trapped wash basins should be fitted up in each room. In the dressing rooms and in the corridors and stairs leading from them to the stage all draughts must be avoided, as the performers often become overheated from the excitement of the acting, and dancers in particular leave the heated stage bathed in perspiration. Sanitation, ventilation, and cleanliness are quite as necessary for this part of the stage building as for the auditorium and foyers.

It will suffice to mention that defects in the drainage and sewerage of a theater building must be avoided. The well-known requirements of house drainage should be observed in theaters as much as in other public buildings.*

The removal of ashes, litter, sweepings, oily waste, and other refuse should be attended to with promptness and regularity. It is only by constant attention to properly carried out cleaning methods that such a building for the public can be kept in a proper sanitary condition. Floating air impurities, like dust and dirt, can not be removed or rendered innocuous by the most perfect ventilating scheme. Mingled with the dust floating in the auditorium or lodging in the stage scenery are numbers of bacteria or germs. Among the pathogenic germs will be those of tuberculosis, contained in the sputum discharged in coughing or expectorating. When this dries on the carpeted floor, the germs become readily detached, are inhaled by the playgoers, and thus become a prolific source of danger. It is for this reason principally that the processes of cleaning, sweeping, and dusting should in a theater be under intelligent management.

To guard against the ever-present danger of infection by germs, the sanitary floor coverings recommended should be wiped every day with a moist rag or cloth. Carpeted floors should be covered with moist tea leaves or sawdust before sweeping to prevent the usual dust-raising. The common use of the feather duster is to

---

* The reader will find the subject discussed and illustrated in the author's work, Sanitary Engineering of Buildings, vol. i, 1899.

be deprecated, for it only raises and scatters the dust, but it does not remove it. Dusting of the furniture should be done with a dampened dust cloth. The cleaning should include the hot-air registers, where a large amount of dust collects, which can only be removed by occasionally opening up the register faces and wiping out the pipe surfaces; also the baseboards and all cornice projections on which dust constantly settles. While dusting and sweeping, the windows should be opened; an occasional admission of sunlight, where practicable, would likewise be of the greatest benefit.

The writer believes that a sanitary inspection of theater buildings should be instituted once a year when they are closed up in summer. He would also suggest that the granting of the annual license should be made dependent not only, as at present, upon the condition of safety of the building against fire and panic, but also upon its sanitary condition. In connection with the sanitary inspection, a thorough disinfection by sulphur, or better with formaldehyde gas, should be carried out by the health authorities. If necessary, the disinfection of the building should be repeated several times a year, particularly during general epidemics of influenza or pneumonia.

Safety measures against outbreaks of fire, dangers from panic, accidents, etc., are in a certain sense also sanitary improvements, but can not be discussed here.*

In order to anticipate captious criticisms, the writer would state that in this paper he has not attempted to set forth new theories, nor to advocate any special system of theater ventilation. His aim was to describe existing defects and to point out well-known remedies. The question of efficient theater sanitation belongs quite as much to the province of the sanitary engineer as to that of the architect. It is one of paramount importance—certainly more so than the purely architectural features of exterior and interior decoration.

In presenting to the British Association the final report on the northwestern tribes of Canada, Professor Tylor observed that, while the work of the committee has materially advanced our knowledge of the tribes of British Columbia, the field of investigation is by no means exhausted. The languages are still known only in outlines. More detailed information on physical types may clear up several points that have remained obscure, and a fuller knowledge of the ethnology of the northern tribes seems desirable. Ethnological evidence has been collected bearing upon the history of the development of the area under consideration, but no archæological investigations, which would help materially in solving these problems, have been carried on.

* See the author's work, Theater Fires and Panics, 1895.

THE NEW FIELD BOTANY.

By BYRON D. HALSTED, Sc. D.,
OF RUTGERS COLLEGE.

THERE is something novel every day; were it not so this earth would grow monotonous to all, even as it does now to many, and chiefly because such do not have the opportunity or the desire to learn some new thing. Facts unknown before are constantly coming to the light, and principles are being deduced that serve as a stepping stone to other and broader fields of knowledge. So accustomed are we to this that even a new branch of science may dawn upon the horizon without causing a wonder in our minds. In this day of ologies the birth of a new one comes without the formal two-line notice in the daily press, just as old ones pass from view without tear or epitaph.

Phytoecology as a word is not long as scientific terms go, and the Greek that lies back of it barely suggests the meaning of the term, a fact not at all peculiar to the present instance. Of course, it has to do with plants, and is therefore a branch of botany.

In one sense that which it stands for is not new, and, as usual, the word has come in the wake of the facts and principles it represents, and therefore becomes a convenient term for a branch of knowledge—a handle, so to say—by which that group of ideas may be held up for study and further growth. The word *ecology* was first employed by Haeckel, a leading light in zoölogy in our day, to designate the environmental side of animal life.

We will not concern ourselves with definitions, but discuss the field that the term is coined to cover, and leave the reader to formulate a short concise statement of its meaning.

Within the last year a new botanical guide book for teachers has been published, of considerable originality and merit, in which the subject-matter is thrown into four groups, and one of these is Ecology. Another text-book for secondary schools is now before us in which ecology is the heading of one of the three parts into which the treatise is divided. The large output of the educational press at the present time along the line in hand suggests that the magazine press should sound the depths of the new branch of science that is pushing its way to the front, or being so pushed by its adherents, and echo the merits of it along the line.

Botany in its stages of growth is interesting historically. It fascinated for a time one of the greatest minds in the modern school, and as a result we have the rich and fruitful history of the science as seen through eyes as great as Julius Sachs's, the mas-

ter of botany during the last half century. From this work it can be gathered that early in the centuries since the Christian era botany was little more than herborizing—the collecting of specimens, and learning their gross parts, as size of stem and leaf and blossom.

This branch of botany has been cultivated to the present day, and the result is the systematist, with all the refinements of species making and readjustment of genera and orders with the nicety of detail in specific descriptions that only a systematist can fully appreciate.

Later on the study of function was begun, and along with it that of structure; for anatomy and physiology, by whatever terms they may be known, advance hand in hand, because inseparable. One worker may look more to the activities than another who toils with the structural relations and finds these problems enough for a lifetime.

This botany of the dissecting table in contrast with that of the collector and his dried specimens grew apace, taking new leases of life at the uprising of new hypotheses, and long advances with the improvement of implements for work. It was natural that the cell and all that is made from it should invite the inspector to a field of intense interest, somewhat at the expense of the functions of the parts. In short, the field was open, the race was on, and it was a matter of self-restraint that a man did not enter and strive long and well for some anatomical prize. This branch of botany is still alive, and never more so than to-day, when cytology offers many attractive problems for the cytologist. What with his microtome that cuts his imbedded tissue into slices so thin that twenty-five hundred or more are needed to measure an inch in thickness, with his fixing solutions that kill instantly and hold each particle as if frozen in a cake of ice, and his stains and double stains that pick out the specks as the magnet draws iron filling from a bin of bran—with all these and a hundred more aids to the refinement of the art there is no wonder that the cell becomes a center of attraction, beyond the periphery of which the student can scarcely live. In our closing days of the century it may be known whether the blephroblasts arise antipodally, and whether they are a variation of the centrosomes or should be classed by themselves!

One of the general views of phytoecology is that the forms of plants are modified to adapt them to the conditions under which they exist. Thus the size of a plant is greatly modified by the environment. Two grains of corn indistinguishable in themselves and borne by the same cob may be so situated that one grows into a stately stalk with the ear higher than a horse's head, while the

other is a dwarf and unproductive. Below ground the conditions are many, and all subject to infinite variation. Thus, the soil may be deep or shallow, the particles small or large, the moisture abundant or scant, and the food elements close at hand or far to seek—all of which will have a marked influence upon the root system, its size, and form.

Coming to the aërial portion, there are all the factors of weather and climate to work singly or in union to affect the aboveground structure of the plant. Temperature varies through wide ranges of heat and cold, scorching and freezing; while humidity or aridity, sunshine or cloudiness, prevailing winds or sudden tornadoes all have an influence in shaping the structure, developing the part, and fashioning the details of form of the aërial portions. Phytoecology deals with all these, and includes the consideration of that struggle for life that plants are constantly waging, for environment determines that the forms best suited to a given set of conditions will survive. This struggle has been going on since the vegetable life of the earth began, and as a result certain prevailing conditions have brought about groups of plants found as a rule only where these conditions prevail. As water is a leading factor in plant growth, a classification is made upon this basis into the plants of the arid regions called xerophytes. The opposite to desert vegetation is that of the fresh ponds and lakes, called hydrophytes. A third group, the halophytes, includes the vegetation of sea or land where there is an excess of various saline substances, the common salt being the leading one. The last group is the mesophytes, which include plants growing in conditions without the extremes accorded to the other three groups.

This somewhat general classification of the conditions of the environment lends much of interest to that form of field botany now under consideration. As the grouping is made chiefly upon the aqueous conditions, it is fair to assume that plants are especially modified to accommodate themselves to this compound. Plants, for example, unless they are aquatics, need to use large quantities of water to carry on the vital functions. Thus the salts from the soil need to rise dissolved in the crude sap to the leaves, and in order that a sufficient current be kept up there is transpiration going on from all thin or soft exposed parts. The leaves are the chief organs where aqueous vapor is being given off, sometimes to the extent of tons of water upon an acre of area in a single day. This evaporation being largely surface action, it is possible for the plant to check this by reducing the surface, and the leaf is coiled or folded. Other plants have through the ages become adapted to the destructive actions of drought and a dry, hot atmosphere, and

have only needle-shaped leaves or even no true ones at all, as many of the cacti in the desert lands of the Western plains.

Again, the surface of the plant may become covered with a felt of fine hairs to prevent rapid evaporation, while other plants with ordinary foliage have the acquired power of moving the leaves so that they will expose their surfaces broadside to the sun, or contrariwise the edges only, as heat and light intensity determine.

Phytoecology deals with all those adaptations of structure, and from which permit the plants to take advantage of the habits and wants of animals. If we are studying the vegetation of a bog, and note the adaptation of the hydrophytic plants, the chances are that attention will soon be called to colorations and structures that indicate a more complete and far-reaching adjustment than simply to the conditions of the wet, spongy bog. A plant may be met with having the leaves in the form of flasks or pitchers, and more or less filled with water. These strange leaves are conspicuously purplish, and this adds to their attractiveness. The upper portion may be variegated, resembling a flower and for the same purpose—namely, to attract insects that find within the pitchers a food which is sought at the risk of life. Many of the entrapped creatures never escape, and yield up their life for the support of that of the captor. Again, the mossy bog may glisten in the sun, and thousands of sundew plants with their pink leaves are growing upon the surface. Each leaf is covered with adhesive stalked glands, and insects lured to and caught by them are devoured by this insectivorous vegetation.

In the pools in the same lowland there may be an abundance of the bladderwort, a floating plant with flowers upon long stalks that raise them into the air and sunshine. With the leaves reduced to a mere framework that bears innumerable bladders, water animals of small size are captured in vast numbers and provide a large part of the nourishment required by the highly specialized hydrophyte.

These are but everyday instances of adaptation between plants and animals for the purpose of nutrition, the adjustment of form being more particularly upon the vegetative side. Zoölogists may be able to show, however, that certain species of animals are adapted to and quite dependent upon the carnivorous plants.

An ecological problem has been worked out along the above line to a larger extent than generally supposed. If we should take the case of ants only in their relation to structural adaptations for them in plants, it would be seen that fully three thousand species of the latter make use of ants for purposes of protection. The large fighting ants of the tropics, when provided with nectar, food,

and shelter, will inhabit plants to the partial exclusion of destructive insects and larger foraging animals. Interesting as all this is, it is not the time and place to go into the details of how the ant-fostering plants have their nectar glands upon stems or leaf, rich soft hairs in tufts for food, and homes provided in hollows and chambers. There is still a more intimate association of termites with some of the toadstool-like plants, where the ants foster the fungi and seem to understand some of the essentials of veritable gardening in miniature form.

The most familiar branch of phytoecology, as it concerns adaptations for insect visitations, is that which relates to the production of seed. Floral structures, so wonderfully varied in form and color and withal attractive to every lover of the beautiful, are familiar to all, and it only needs to be said in passing that these infinite forms are for the same end—namely, the union of the seed germs, if they may be so styled, of different and often widely separated blossoms.

Sweetness and beauty are not the invariable rule with insect-visited blossoms, for in the long ages that have elapsed during which these adaptations have come about some plants have established an unwritten agreement between beetles and bugs with unsavory tastes. Thus there are the "carrion flowers," so called because of their fetid odor, designed for the sense organs of carrion insects. The "stink-horn" fungi have their offensive spores distributed by a similar set of carrion carriers.

Water and wind claim a share of the species, but here adaptation to the method of fertilization is as fully realized as when insects participate, and the uselessness of showy petals and fantastic forms is emphasized by their absence.

Coming now to the fruits of plants, it is again seen that plants have adapted their offspring, the seed, to the surrounding conditions, not forgetting the wind, the waves, and the tastes and the exterior of passing animals. The breezes carry up and hurl along the light wing-possessed seeds, and the river and ocean bear these and many others onward to a distant land, while by grappling hooks many kinds cling to the hair of animals, or, provided with a pleasing pulp, are carried willingly by birds and other creatures. In short, the devices for seed dispersion are multitudinous, and they provide a large chapter in that branch of botany now styled phytoecology.

How different is the old field botany from the new! Then there was the collector of plants and classifier of his finds, and an arranger of all he could get by exchange or otherwise. His success was measured by the size of his herbarium and his stock in

trade as so many duplicates all taken in bloom, but the time of year, locality, and the various conditions of growth were all unknown.

His implements for work were, first, a can or basket, a plant press, and a manual; and, secondly, a lot of paper, a paste pot, and some way of holding the mounts in packets or pigeonholes.

The eyes grew keen as the hunter scoured the forest and field for some kind of plant he had not already possessed. There was a keen relish in discoveries, and it heightened into ecstasy when the specimen needed to be sent away for a name and was returned with his own Latinized and appended to that of the genus.

This was all well and good so far as it went, but looked at from the present vantage ground there was not so much in it. However, his was an essential step to other things, as much so as that of the census taker.

We need to know the species of plants our fair land possesses, and have them described and named. But when the nine hundred and ninety-nine are known, it is a waste of time to be continually hunting for the thousandth. Look for it, but let it be secondary to that of an actual study of the great majority already known. The older botany was a study of the dried plants in all those details that are laid down in the manuals. It lacked something of the true vitality that is inherent in a biological science, for often the life had gone out before the subject came up for study. To the phytoecologist it was somewhat as the shell without the meat, or the bird's nest of a previous year.

Since those days of our forefathers there has come the minute anatomy of plants, followed closely by physiology; and now with the working knowledge of these two modern branches of botany the student has again taken to the field. He is making the wood-lot his laboratory, and the garden, so to say, his lecture room. He has a fair knowledge of systematic botany, but finds himself rearranging the families and genera to fit the facts determined by his ecological study. If two species of the same genus are widely separated in habitat, he is determining the factors that led to the separation. Why did one smart weed become a climber, another an upright herb, and a third a prostrate creeper, are questions that may not have entered the mind of the plant collector; but now the phytoecologist finds much interest in considering questions of this type. What are the differences between a species inhabiting the water and another of the same genus upon dry land, or what has led one group of the morning-glory family to become parasites and exist as the dodders upon other living plants?

The older botanist held his subject under the best mental illumination of his time, but his physical light, that of a pine knot

or a tallow dip, also contrasts strongly with that of the present gas jet and electric arc.

The wonder should be that he saw so well, and all who follow him can not but feel grateful for the path he blazed through the dense forests of ignorance and the bridges he made over the streams of doubt in specific distinctions. It was a noble work, but it is nearly past in the older parts of our country; and while some of that school should linger to readjust their genera, make new combinations of species, and attempt to satisfy the claims of priority, the rank and file will largely leave systematic botany and the herborizing it embraces, and betake themselves to the open fields of phytoecology. It may be along the line of structural adaptations when we will have morphological phytoecology, or the adjustment of function to the environment when there will be physiological phytoecology. These two branches when combined to elucidate problems of relationship between the plant and its surroundings as involved in accommodation in its comprehensive sense there will be phytoecology with climate, geology, geography, or fossils as the leading feature, as the case may be.

In the older botany the plant alone in itself was the subject of study. The newer botany takes the plant in its surroundings and all that its relationships to other plants may suggest as the subject for analysis. In the one case the plant was all and its place of growth accidental, a dried specimen from any unknown habitat was enough; but now the environment and the numerous lines of relationship that reach out from the living plant *in situ* are the major subjects for study. The former was field botany because the field contained the plant, the latter is field botany in that the plant embraces in its study all else in the field in which it lives. The one had as its leading question, What is your name and where do you belong in my herbarium? while the other raises an endless list of queries, of which How came you here and when? Why these curious glands and this strange movement or mimicry? are but average samples. Every spot of color, bend of leaf, and shape of fruit raises a question.

The collector of fifty years ago pulled up or cut off a portion of his plant for a specimen, and rarely measured, weighed, and counted anything about it. The phytoecologist to-day watches his subject as it grows, and if removed it is for the purpose of testing its vital functions under varying circumstances of moisture, heat, or sunlight, and exact recording instruments are a part of the equipment for the investigation.

The underlying thought in the seashore school and the tropical laboratory in botany is this of getting nearer to the haunts of the

living plant. Forestry schools that have for their class room the wooded mountains and the botanical gardens with their living herbaria are welcome steps toward the same end of phytoecology.

In view of the above facts, and many more that might be mentioned did space permit, the writer has felt that the present incomplete and faulty presentation of the subject of the newer botany should be placed before the great reading public through the medium of a journal that has as its watchword Progress in Education.

DO ANIMALS REASON?

By the Rev. EGERTON R. YOUNG.

THIS interesting subject has been ably handled from the negative side by Edward Thorndike, Ph. D., in the August number of the Popular Science Monthly. Dr. Thorndike, with all his skill in treating this very interesting subject, seems to have forgotten one very important point. His expectation has not only been higher than any fair claim of an animal's reasoning power, but he has overlooked the fact that there are different ways of reasoning. Men of different races and those of little intelligence can be placed in new environments and be asked to perform things which, while utterly impossible to them, are simple and crude to those of higher intelligence and who have all their days been accustomed to high mental exercise. If such difference exists between the highest and most intelligent of the human race and the degraded and uncultured, vastly greater is the gulf that separates the lowest stratum of humanity from the most intelligent of the brute creation. The fair way to test the intelligence of the so-called lower orders of men is to go to their native lands and study them in their own environments and in possession of the equipments of life to which they have been accustomed. The same is true of the brute creation. Only the highest results can be expected from congenial environments. To pass final judgment upon the animal kingdom, having for data only the results of the doctor's experiments, seems to us manifestly unfair. He takes a few cats and dogs and submits them to environments which are altogether foreign to them, and then expects feats of mind from them which would be far greater than the mastering of the reason why two and two make four is to the stupidest child of man. As the doctor has been permitted to tell the results of his experiments, may I claim a similar privilege? While I did not use dogs merely to test their intelligence—my business demanding of myself and

them the fullest use of all our energies and all the intelligence, be it more or less, that was possessed by man or beast—I had the privilege of seeing in my dogs actions that were, at least to me, convincing that they possessed the rudiments of reasoning powers, and, in the more intelligent, that which will be utterly inexplicable if it is not the product of reasoning faculties.

For a number of years I was a resident missionary in the Hudson Bay Territories, where, in the prosecution of my work, I kept a large number of dogs of various breeds. With these dogs I traveled several thousands of miles every winter over an area larger than the State of New York. In summer I used them to plow my garden and fields. They dragged home our fish from the distant fisheries, and the wood from the forests for our numerous fires. They cuddled around me on the edges of my heavy fur robes in wintry camps, where we often slept out in a hole dug in the snow, the temperature ranging from 30° to 60° below zero. When blizzard storms raged so terribly that even the most experienced Indian guides were bewildered, and knew not north from south or east from west, our sole reliance was on our dogs, and with an intelligence and an endurance that ever won our admiration they succeeded in bringing us to our desired destination.

It is conceded at the outset that these dogs of whom I write were the result of careful selection. There are dogs and dogs, as there are men and men. They were not picked up in the street at random. I would no more keep in my personal service a mere average mongrel dog than I would the second time hire for one of my long trips a sulky Indian. As there are some people, good in many ways, who can not master a foreign tongue, so there are many dogs that never rise above the one gift of animal instinct. With such I too have struggled, and long and patiently labored, and if of them only I were writing I would unhesitatingly say that of them I never saw any act which ever seemed to show reasoning powers. But there are other dogs than these, and of them I here would write and give my reason why I firmly believe that in a marked degree some of them possessed the powers of reasoning.

Two of my favorite dogs I called Jack and Cuffy. Jack was a great black St. Bernard, weighing nearly two hundred pounds. Cuffy was a pure Newfoundland, with very black curly hair. These two dogs were the gift of the late Senator Sanford. With other fine dogs of the same breeds, they soon supplanted the Eskimo and mongrels that had been previously used for years about the place.

I had so much work to do in my very extensive field that I required to have at least four trains always fit for service. This

meant that, counting puppies and all, there would be about the premises from twenty to thirty dogs. However, as the lakes and rivers there swarmed with fish, which was their only food, we kept the pack up to a state of efficiency at but little expense. Jack and Cuffy were the only two dogs that were allowed the full

JACK AND HIS MASTER.

liberty of the house. They were welcome in every room. Our doors were furnished with the ordinary thumb latches. These latches at first bothered both dogs. All that was needed on our part was to show them how they worked, and from that day on for years they both entered the rooms as they desired without any trouble,

if the doors opened from them. There was a decided difference, however, in opening a door if it opened toward them. Cuffy was never able to do it. With Jack it was about as easily done as it was by the Indian servant girl. Quickly and deftly would he shove up the exposed latch and the curved part of the thumb piece and draw it toward him. If the door did not easily open, the claws in the other fore paw speedily and cleverly did the work. The favorite resting place of these two magnificent dogs was on some fur rugs on my study floor. Several times have we witnessed the following action in Cuffy, who was of a much more restless temperament than Jack: When she wanted to leave the study she would invariably first go to the door and try it. If it were in the slightest degree ajar she could easily draw it toward her and thus open it. If, on the contrary, it were latched, she would at once march over to Jack, and, taking him by an ear with her teeth, would lead him over to the door, which he at once opened for her. If reason is that power by which we "are enabled to combine means for the attainment of particular ends," I fail to understand the meaning of words if it were not displayed in these instances.

Both Jack and Cuffy were, as is characteristic of such dogs, very fond of the water, and in our short, brilliant summers would frequently disport themselves in the beautiful little lake, the shores of which were close to our home. Cuffy, as a Newfoundland dog, generally preferred to continue her sports in the waves some time after Jack had finished his bath. As they were inseparable companions, Jack was too loyal to retire to the house until Cuffy was ready to accompany him. As she was sometimes whimsical and dilatory, she seemed frequently to try his patience. It was, however, always interesting to observe his deference to her. To understand thoroughly what we are going to relate in proof of our argument it is necessary to state that the rocky shore in front of our home was at this particular place like a wedge, the thickest part in front, rising up about a dozen feet or so abruptly from the water. Then to the east the shore gradually sloped down into a little sandy cove. When Jack had finished his bath he always swam to this sandy beach, and at once, as he shook his great body, came gamboling along the rocks, joyously barking to his companion still in the waters. When Cuffy had finished her watery sports, if Jack were still on the rocks, instead of swimming to the sandy cove and there landing she would start directly for the place where Jack was awaiting her. If it were at a spot where she could not alone struggle up, Jack, firmly bracing himself, would reach down to her and then, catching hold of the back of her neck, would help her

up the slippery rocks. If it were at a spot where he could not possibly reach her, he would, after several attempts, all the time furiously barking as though expressing his anxiety and solicitude, rush off to a spot where some old oars, paddles, and sticks of various kinds were piled. There he searched until he secured one that suited his purpose. With this in his mouth, he hurried back to the spot where Cuffy was still in the water at the base of the steep rocks. Here he would work the stick around until he was able to let one end down within reach of his exacting companion in the water. Seizing it in her teeth and with the powerful Jack pulling at the other end she was soon able to work her way up the rough but almost perpendicular rocks. This prompt action, often repeated on the part of Jack, looked very much like "the specious appearance of reasoning." It was a remarkable coincidence that if Jack were called away, Cuffy at once swam to the sandy beach and there came ashore.

Jack never had any special love for the Indians, although we were then living among them. He was, however, too well instructed ever to injure or even growl at any of them. The changing of Indian servant girls in the kitchen was always a matter of perplexity to him. He was suspicious of these strange Indians coming in and so familiarly handling the various utensils of their work. Not daring to injure them, it was amusing to watch him in his various schemes to tease them. If one of them seemed especially anxious to keep the doors shut, Jack took the greatest delight in frequently opening them. This he took care only to do when no member of the family was around. These tricks he would continue to do until formal complaints were lodged against him. One good scolding was sufficient to deter him from thus teasing that girl, but he would soon begin to try it with others.

One summer we had a fat, good-natured servant girl whom we called Mary. Soon after she was installed in her place Jack began, as usual, to try to annoy her, but found it to be a more difficult job than it had been with some of her predecessors. She treated him with complete indifference, and was not in the least afraid of him, big as he was. This seemed to very much humiliate him, as most of the other girls had so stood in awe of the gigantic fellow that they had about given way to him in everything. Mary, however, did nothing of the kind. She would shout, "Get out of my way!" as quickly to "his mightiness" as she would to the smallest dog on the place. This very much offended Jack, but he had been so well trained, even regarding the servants, that he dare not retaliate even with a growl. Mary, however, had one weakness, and after a time Jack found it out. Her mistress observing that

this girl, who had been transferred from a floorless wigwam into a civilized kitchen, was at first careless about keeping the floor as clean as it should be, had, by the promise of some desired gift in addition to her wages, so fired her zeal that it seemed as though every hour that could be saved from her other necessary duties was spent in scrubbing that kitchen floor. Mary was never difficult to find, as was often the case with other Indian girls; if missed from other duties, she was always found scrubbing her kitchen.

In some way or other—how we do not profess to know—Jack discovered this, which had become to us a source of amusement, and here he succeeded in annoying her, where in many other ways which he had tried he had only been humiliated and disgraced. He would, when the floor had just been scrubbed, march in and walk over it with his feet made as dirty as tramping in the worst places outside could make them. At other times he would plunge into the lake, and instead of, as usual, thoroughly shaking himself dry on the rocks, would wait until he had marched in upon Mary's spotless floor. At other times, when Jack noticed that Mary was about to begin scrubbing her floor he would deliberately stretch himself out in a prominent place on it, and doggedly resist, yet without any growling or biting, any attempt on her part to get him to move. In vain would she coax or scold or threaten. Once or twice, by some clever stratagem, such as pretending to feed the other dogs outside or getting them excited and furiously barking, as though a bear or some other animal were being attacked, did she succeed in getting him out. But soon he found her out, and then he paid not the slightest attention to any of these things. Once when she had him outside she securely fastened the door to keep him out until her scrubbing would be done. Furiously did Jack rattle at the latch, but the door was otherwise so secured that he could not open it. Getting discouraged in his efforts to open the door in the usual way, he went to the woodpile and seizing a large billet in his mouth he came and so pounded the door with it that Mary, seeing that there was great danger of the panel being broken in, was obliged to open the door and let in the dog. Jack proudly marched in to the kitchen with the stick of wood in his mouth. This he carried to the wood box, and, when he had placed it there, he coolly stretched himself out on the floor where he would be the biggest nuisance.

Seeing Jack under such circumstances on her kitchen floor, poor Mary could stand it no longer, and so she came marching in to my study, and in vigorous picturesque language in her native Cree described Jack's various tricks and schemes to annoy her and thus hinder her in her work. She ended up by the declaration

that she was sure the *meechee munedoo* (the devil) was in that dog. While not fully accepting the last statement, we felt that the time had come to interfere, and that Jack must be reproved and stopped. In doing this we utilized Jack's love for our little ones, especially for Eddie, the little four-year-old boy. His obedience as well as loyalty to that child was marvelous and beautiful. The slightest wish of the lad was law to Jack.

As soon as Mary had finished her emphatic complaints, I turned to Eddie, who with his little sister had been busily playing with some blocks on the floor, and said:

"Eddie, go and tell that naughty Jack that he must stop teasing Mary. Tell him his place is not in the kitchen, and that he must keep out of it."

Eddie had listened to Mary's story, and, although he generally sturdily defended Jack's various actions, yet here he saw that the dog was in the wrong, and so he gallantly came to her rescue. Away with Mary he went, while the rest of us, now much interested, followed in the rear to see how the thing would turn out. As Eddie and Mary passed through the dining room we remained in that room, while they went on into the adjoining kitchen, leaving the door open, so that it was possible for us to distinctly hear every word that was uttered. Eddie at once strode up to the spot where Jack was stretched upon the floor. Seizing him by one of his ears, and addressing him as with the authority of a despot, the little lad said:

"I am ashamed of you, Jack. You naughty dog, teasing Mary like this! So you won't let her wash her kitchen. Get up and come with me, you naughty dog!" saying which the child tugged away at the ear of the dog. Jack promptly obeyed, and as they came marching through the dining room on their way to the study it was indeed wonderful to see that little child, whose beautiful curly head was not much higher than that of the great, powerful dog, yet so completely the master. Jack was led into the study and over to the great wolf-robe mat where he generally slept. As he promptly obeyed the child's command to lie down upon it, he received from him his final orders:

"Now, Jack, you keep out of the kitchen"; and to a remarkable degree from that time on that order was obeyed.

We have referred to the fact that Jack placed the billet of wood in the wood box when it had served his purpose in compelling Mary to open the door. Carrying in wood was one of his accomplishments. Living in that cold land, where we depended entirely on wood for our fuel, we required a large quantity of it. It was cut in the forests, sometimes several miles from the house. Dur-

ing the winters it was dragged home by the dogs. Here it was cut into the proper lengths for the stoves and piled up in the yard. When required, it was carried into the kitchen and piled up in a large wood box. This work was generally done by Indian men. When none were at hand the Indian girls had to do the work, but it was far from being enjoyed by them, especially in the bitter cold weather. It was suggested one day that Jack could be utilized for this work. With but little instruction and trouble he was induced to accept of the situation, and so after that the cry, "Jack, the wood box is empty!" would set him industriously to work at refilling it.

To us, among many other instances of dog reasoning that came under our notice as the years rolled on, was one on the part of a large, powerful dog we called Caesar. It occurred in the spring of the year, when the snow had melted on the land, and so, with the first rains, was swelling the rivers and creeks very considerably. On the lake before us the ice was still a great solid mass, several feet in thickness. Near our home was a now rapid stream that, rushing down into the lake, had cut a delta of open water in the ice at its mouth. In this open place Papanekis, one of my Indians, had placed a gill net for the purpose of catching fish. Living, as he did, all winter principally upon the fish caught the previous October or November and kept frozen for several months hung up in the open air, we were naturally pleased to get the fresh ones out of the water in the spring. Papanekis had so arranged his net, by fastening a couple of ropes about sixty feet long, one at each end, that when it was securely fastened at each side of the stream it was carried out into this open deltalike space by the force of the current, and there hung like the capital letter U. Its upper side was kept in position by light-wooded floats, while medium-sized stones, as sinkers, steadied it below.

Every morning Papanekis would take a basket and, being followed by all the dogs of the kennels, would visit his net. Placed as we have described, he required no canoe or boat in order to overhaul it and take from it the fish there caught. All he had to do was to seize hold of the rope at the end fastened on the shore and draw it toward him. As he kept pulling it in, the deep bend in it gradually straightened out until the net was reached. His work was now to secure the fish as he gradually drew in the net and coiled it at his feet. The width of the opening in the water being about sixty feet, the result was that when he had in this way overhauled his net he had about reached the end of the rope attached to the other side. When all the fish in the net were secured, all Papanekis had to do to reset the net was to throw some of it out

in the right position in the stream. Here the force of the running waters acting upon it soon carried the whole net down into the open place as far as the two ropes fastened on the shores would admit. Papanekis, after placing the best fish in his basket for consumption in the mission house and for his own family, divided what was left among the eager dogs that had accompanied him. This work went on for several days, and the supply of fish continued to increase, much to our satisfaction.

One day Papanekis came into my study in a state of great perturbation. He was generally such a quiet, stoical sort of an Indian that I was at once attracted by his mental disquietude. On asking the reason why he was so troubled, he at once blurted out, "Master, there is some strange animal visiting our net!"

In answer to my request for particulars, he replied that for some mornings past when he went to visit it he found, entangled in the meshes, several heads of whitefish. Yet the net was always in its right position in the water. On my suggesting that perhaps otters, fishers, minks, or other fish-eating animals might have done the work, he most emphatically declared that he knew the habits of all these and all other animals living on fish, and it was utterly impossible for any of them to have thus done this work. The mystery continuing for several following mornings, Papanekis became frightened and asked me to get some other fisherman in his place, as he was afraid longer to visit the net. He had talked the matter over with some other Indians, and they had come to the conclusion that either a *windegoo* was at the bottom of it or the *meechee munedoo* (the devil). I laughed at his fears, and told him I would help him to try and find out who or what it was that was giving us this trouble. I went with him to the place, where we carefully examined both sides of the stream for evidences of the clever thief. There was nothing suspicious, and the only tracks visible were those of his own and of the many dogs that followed him to be fed each morning. About two or three hundred yards north of the spot where he overhauled the net there rose a small abrupt hill, densely covered with spruce and balsam trees. On visiting it we found that a person there securely hid from observation could with care easily overlook the whole locality.

At my suggestion, Papanekis with his axe there arranged a sort of a nest or lookout spot. Orders were then given that he and another Indian man should, before daybreak on the next morning, make a long detour and cautiously reach that spot from the rear, and there carefully conceal themselves. This they succeeded in doing, and there, in perfect stillness, they waited for the morning. As soon as it was possible to see anything they were on

the alert. For some time they watched in vain. They eagerly scanned every point of vision, and for a time could observe nothing unusual.

"Hush!" said one; "see that dog!"

It was Cæsar, cautiously skulking along the trail. He would frequently stop and sniff the air. Fortunately for the Indian watchers, the wind was blowing toward them, and so the dog did not catch their scent. On he came, in a quiet yet swift gait, until he reached the spot where Papanekis stood when he pulled in the net. He gave one searching glance in every direction, and then he set to work. Seizing the rope in his teeth, Cæsar strongly pulled upon it, while he rapidly backed up some distance on the trail. Then, walking on the rope to the water's edge as it lay on the ground, to keep the pressure of the current from dragging it in, he again took a fresh grip upon it and repeated the process. This he did until the sixty feet of rope were hauled in, and the end of the net was reached to which it was attached. The net he now hauled in little by little, keeping his feet firmly on it to securely hold it down. As he drew it up, several varieties of inferior fish, such as suckers or mullets, pike or jackfish, were at first observed. To them Cæsar paid no attention. He was after the delicious whitefish, which dogs as well as human beings prefer to those of other kinds. When he had perhaps hauled twenty feet of the net, his cleverness was rewarded by the sight of a fine whitefish. Still holding the net with its struggling captives securely down with his feet, he began to devour this whitefish, which was so much more dainty than the coarser fish generally thrown to him. Papanekis and his comrade had seen enough. The mysterious culprit was detected in the act, and so with a "Whoop!" they rushed down upon him. Caught in the very act, Cæsar had to submit to a thrashing that ever after deterred him from again trying that cunning trick.

Who can read this story, which I give exactly as it occurred, without having to admit that here Cæsar "combined means for the attainment of particular ends"? On the previous visits which he made to the net the rapid current of the stream, working against the greater part of it in the water, soon carried it back again into its place ere Papanekis arrived later in the morning. The result was that Cæsar's cleverness was undetected for some time, even by these most observant Indians.

Many other equally clever instances convince me, and those who with me witnessed them, of the possession, in of course a limited degree, of reasoning powers. Scores of my dogs never seemed to reveal them, perhaps because no special opportunities were presented for their exhibition. They were just ordinary dogs, trained

to the work of hauling their loads. When night came, if their feet were sore they had dog sense enough to come to their master and, throwing themselves on their backs, would stick up their feet and whine and howl until the warm duffle shoes were put on. Some of the skulking ones had wit enough, when they did not want to be caught, in the gloom of the early morning, while the stars were still shining, if they were white, to cuddle down, still and quiet, in the beautiful snow; while the darker ones would slink away into the gloom of the dense balsams, where they seemed to know that it would be difficult for them to be seen. Some of them had wit enough when traveling up steep places with heavy loads, where their progress was slow, to seize hold of small firm bushes in their teeth to help them up or to keep them from slipping back. Some of them knew how to shirk their work. Cæsar, of whom we have already spoken, at times was one of this class. They could pretend, by their panting and tugging at their collars, that they were dragging more than any other dogs in the train, while at the same time they were not pulling a pound!

Of cats I do not write. I am no lover of them, and therefore am incompetent to write about them. This lack of love for them is, I presume, from the fact that when a boy I was the proud owner of some very beautiful rabbits, upon which the cats of the neighborhood used to make disastrous raids. So great was my boyish indignation then that the dislike to them created has in a measure continued to this day, and I have not as yet begun to cultivate their intimate acquaintance.

But of dogs I have ever been a lover and a friend. I never saw one, not mad, of which I was afraid, and I never saw one with which I could not speedily make friends. Love was the constraining motive principally used in breaking my dogs in to their work in the trains. No whip was ever used upon Jack or Cuffy while they were learning their tasks. Some dogs had to be punished more or less. Some stubborn dogs at once surrendered and gave no more trouble when a favorite female dog was harnessed up in a train and sent on ahead. This affection in the dog for his mate was a powerful lever in the hands of his master, and, using it as an incentive, we have seen things performed as remarkable as any we have here recorded.

From what I have written it will be seen that I have had unusual facilities for studying the habits and possibilities of dogs. I was not under the necessity of gathering up a lot of mongrels at random in the streets, and then, in order to see instances of their sagacity and the exercise of their highest reasoning powers, to keep them until they were "practically utterly hungry," and then

imprison them in a box a good deal less than four feet square, and then say to them, "Now, you poor, frightened, half-starved creatures, show us what reasoning powers you possess." About as well throw some benighted Africans into a slave ship and order them to make a telephone or a phonograph! My comparison is not too strong, considering the immense distance there is between the human race and the brute creation. And so it must be, in the bringing to light of the powers of memory and the clear exhibition of the reasoning powers, few though they be, that the tests are not conclusive unless made under the most favorable environment, upon dogs of the highest intelligence, and in the most congenial and sympathetic manner.

Testing this most interesting question in this manner, my decided convictions are that animals do reason.

SKETCH OF GEORGE M. STERNBERG.

NO man among Americans has studied the micro-organisms with more profit or has contributed more to our knowledge of the nature of infection, particularly of that of yellow fever, than Dr. George M. Sternberg, of the United States Army. His merits are freely recognized abroad, and he ranks there, as well as at home, among the leading bacteriologists of the age. He was born at Hartwick Seminary, an institution of the Evangelical Lutheran Church in America (General Synod), Otsego, N. Y., June 8, 1838. His father, the Rev. Levi Sternberg, D. D., a graduate of Union College, a Lutheran minister, and for many years principal of the seminary and a director of it, was descended from German ancestors who came to this country in 1703 and settled in Schoharie County, New York. The younger Sternberg received his academical training at the seminary, after which, intending to study medicine, he undertook a school at New Germantown, N. J., as a means of earning a part of the money required to defray the cost of his instruction in that science. The record of his school was one of quiet sessions, thoroughness, and popularity of the teacher, and his departure was an occasion of regret among his patrons.

When nineteen years old, young Sternberg began his medical studies with Dr. Horace Lathrop, in Cooperstown, N. Y. Afterward he attended the courses of the College of Physicians and Surgeons, New York, and was graduated thence in the class of 1860. Before he had fairly settled in practice the civil war began, and the

attention of all young Americans was directed toward the military service. Among these was young Dr. Sternberg, who, having passed the examination, was appointed assistant surgeon May 28, 1861, and was attached to the command of General Sykes, Army of the Potomac. He was engaged in the battle of Bull Run, where, voluntarily remaining on the field with the wounded, he was taken prisoner, but was paroled to continue his humane work. On the expiration of his parole he made his way through the lines and reported at Washington for duty July 30, 1861—"weary, footsore, and worn." Of his conduct in later campaigns of the Army of the Potomac, General Sykes, in his official reports of the battles of Gaines Mill, Turkey Ridge, and Malvern Hill, said that "Dr. Sternberg added largely to the reputation already acquired on the disastrous field of Bull Run." He remained with General Sykes's command till August, 1862; was then assigned to hospital duty at Portsmouth Grove, R. I., till November, 1862; was afterward attached to General Banks's expedition as assistant to the medical director in the Department of the Gulf till January, 1864; was in the office of the medical director, Columbus, Ohio, and in charge of the United States General Hospital at Cleveland, Ohio, till July, 1865. Since the civil war he has been assigned successively to Jefferson Barracks, Mo.; Fort Harker and Fort Riley, Kansas; in the field in the Indian campaign, 1868 to 1870; Forts Columbus and Hamilton, New York Harbor; Fort Warren, Boston Harbor; Department of the Gulf and New Orleans; Fort Barrancas, Fla.; Department of the Columbia; Department Headquarters; Fort Walla Walla, Washington Territory; California; and Eastern stations. He was promoted to be captain and assistant surgeon in 1866, major and surgeon in 1875, lieutenant colonel and deputy surgeon general in 1891, and brigadier general and surgeon general in 1893. He has also received the brevets of captain and major in the United States Army "for faithful and meritorious services during the war, and of lieutenant colonel "for gallant service in performance of his professional duty under fire in action against Indians at Clearwater, Idaho, July 12, 1877." In the discharge of his duties at his various posts Dr. Sternberg had to deal with a cholera epidemic in Kansas in 1867, with a "yellow-fever epidemic" in New York Harbor in 1871, and with epidemics of yellow fever at Fort Barrancas, Fla., in 1873 and 1875. He served under special detail as member and secretary of the Havana Yellow-Fever Commission of the National Board of Health, 1879 to 1881; as a delegate from the United States under special instructions of the Secretary of State to the International Sanitary Conference at Rome in 1885; as a commissioner, under

the act of Congress of March 3, 1887, to make investigations in Brazil, Mexico, and Cuba relating to the etiology and prevention of yellow fever; by special request of the health officer of the port of New York and the advisory committee of the New York Chamber of Commerce as consulting bacteriologist to the health officer of the port of New York in 1892; and he was a delegate to the International Medical Congress in Moscow in 1897.

Dr. Sternberg has contributed largely to the literature of scientific medicine from the results of his observations and experiments which he has made in these various spheres of duty.

His most fruitful researches have been made in the field of bacteriology and infectious diseases. He has enjoyed the rare advantage in pursuing these studies of having the material for his experiments close at hand in the course of his regular work, and of watching, we might say habitually, the progress of such diseases as yellow fever as it normally went on in the course of Nature. Of the quality of his bacteriological work, the writer of a biography in Red Cross Notes, reprinted in the North American Medical Review, goes so far as to say that "when the overzeal of enthusiasts shall have passed away, and the story of bacteriology in the nineteenth century is written up, it will probably be found that the chief who brought light out of darkness was George M. Sternberg. He was noted not so much for his brilliant discoveries, but rather for his exact methods of investigation, for his clear statements of the results of experimental data, for his enormous labors toward the perfection and simplification of technique, and finally for his services in the practical application of the truths taught by the science. His early labors in bacteriology were made with apparatus and under conditions that were crude enough." His work in this department is certainly among the most important that has been done. Its value has been freely acknowledged everywhere, it has given him a world-wide fame, and it has added to the credit of American science. The reviewer in Nature (June 22, 1893) of his Manual of Bacteriology, which was published in 1892, while a little disposed to criticise the fullness and large size of the book, describes it as "the latest, the largest, and, let us add, the most complete manual of bacteriology which has yet appeared in the English language. The volume combines in itself not only an account of such facts as are already established in the science from a morphological, chemical, and pathological point of view, discussions on such abstruse subjects as susceptibility and immunity, and also full details of the means by which these results have been obtained, and practical directions for the carrying on of laboratory

work." This was not the first of Dr. Sternberg's works in bacteriological research. It was preceded by a work on Bacteria, of 498 pages, including 152 pages translated from the work of Dr. Antoine Magnin (1884); Malaria and Malarial Diseases, and Photomicrographs and How to make Them. The manual is at once a book for reference, a text-book for students, and a handbook for the laboratory. Its four parts include brief notices of the history of the subject, classification, morphology, and an account of methods and practical laboratory work—" all clear and concise "; the biology and chemistry of bacteria, disinfection, and antiseptics; a detailed account of pathogenic bacteria, their modes of action, the way they may gain access to the system, susceptibility and immunity, to which Dr. Sternberg's own contributions have been not the least important; and saprophytic bacteria in water, in the soil, in or on the human body, and in food, the whole number of saprophytes described being three hundred and thirty-one. "The merit of a work of this kind," Nature says, "depends not less on the number of species described than on the clearness and accuracy of the descriptions, and Dr. Sternberg has spared no pains to make these as complete as possible." The bibliography in this work fills more than a hundred pages, and contains 2,582 references. A later book on a kindred subject is Immunity, Protective Inoculations, and Serum Therapy (1895). Dr. Sternberg has also published a Text-Book of Bacteriology.

Bearing upon yellow fever are the Report upon the Prevention of Yellow Fever by Inoculation, submitted in March, 1888; Report upon the Prevention of Yellow Fever, illustrated by photomicrographs and cuts, 1890; and Examination of the Blood in Yellow Fever (experiments upon animals, etc.), in the Preliminary Report of the Havana Yellow-Fever Commission, 1879. Other publications in the list of one hundred and thirty-one titles of Dr. Sternberg's works, and mostly consisting of shorter articles, relate to Disinfectants and their Value, the Etiology of Malarial Fevers, Septicæmia, the Germicide Value of Therapeutic Agents, the Etiology of Croupous Pneumonia, the Bacillus of Typhoid Fever, the Thermal Death Point of Pathogenic Organisms, the Practical Results of Bacteriological Researches, the Cholera Spirillum, Disinfection at Quarantine Stations, the Infectious Agent of Smallpox, official reports as Surgeon General of the United States Army, addresses and reports at the meetings of the American Public Health Association, and an address to the members of the Pan-American Congress. One paper is recorded quite outside of the domain of microbes and fevers, to show what the author might have done if he had allowed his attention to be diverted from his special absorb-

ing field of work. It is upon the Indian Burial Mounds and Shell Heaps near Pensacola, Fla.

The medical and scientific societies of which Dr. Sternberg is a member include the American Public Health Association, of which he is also an ex-president (1886); the American Association of Physicians; the American Physiological Society; the American Microscopical Society, of which he is a vice-president; the American Association for the Advancement of Science, of which he is a Fellow; the New York Academy of Medicine (a Fellow); and the Association of Military Surgeons of the United States (president in 1896). He is a Fellow of the Royal Microscopical Society of London; an honorary member of the Epidemiological Society of London, of the Royal Academy of Medicine of Rome, of the Academy of Medicine of Rio de Janeiro, of the American Academy of Medicine, of the French Society of Hygiene, etc.; was President of the Section on Military Medicine and Surgery of the Pan-American Congress; was a Fellow by courtesy in Johns Hopkins University, 1885 to 1890; was President of the Biological Society of Washington in 1896, and of the American Medical Association in 1897; and has been designated Honorary President of the Thirteenth International Medical Congress, which is to meet in Paris in 1900. He received the degree of LL. D. from the University of Michigan in 1894, and from Brown University in 1897.

Dr. Sternberg's view of the right professional standard of the physician is well expressed in the sentiment, "To maintain our standing in the estimation of the educated classes we must not rely upon our diplomas or upon our membership in medical societies. Work and worth are what count." He does not appear to be attached to any particular school, but, as his Red Cross Notes biographer says, "has placed himself in the crowd 'who have been moving forward upon the substantial basis of scientific research, and who, if characterized by any distinctive name, should be called *the New School of Scientific Medicine.*' He holds that if our practice was in accordance with our knowledge many diseases would disappear; he sees no room for creeds or patents in medicine. He is willing to acknowledge the right to prescribe either a bread pill or a leaden bullet. But if a patient dies from diphtheria because of a failure to administer a proper remedy, or if infection follows from dirty fingers or instruments, if a practitioner carelessly or ignorantly transfers infection, he believes he is not fit to practice medicine. . . . He rejects every theory or dictum that has not been clearly demonstrated to him as an absolute truth."

While he is described as without assumption, Dr. Sternberg is represented as being evidently in his headquarters as surgeon gen-

eral in every sense the head of the service, the chief whose will governs all. Modest and unassuming, he is described as being most exacting, a man of command, of thorough execution, a general whose eyes comprehend every detail, and who has studied the personality of every member of his corps. He is always busy, but seemingly never in a hurry; systematic, accepting no man's dictum, and taking nothing as an established fact till he has personal experimental evidence of its truth. He looks into every detail, and takes equal care of the health of the general in chief and of the private.

His addresses are carefully prepared, based on facts he has himself determined, made in language so plain that they will not be misunderstood, free from sentiment, and delivered in an easy conversational style, and his writings are "pen pictures of his results in the laboratory and clinic room."

THE thirty-first year of the Peabody Museum of American Archæology and Ethnology was signalized by the transfer of its property to the corporation of Harvard College, whereby simplicity and greater permanence have been given to its management. The four courses of instruction in the museum were attended by sixteen students, and these, with others, make twenty-one persons, besides the curator, who are engaged in study or special research in subjects included under the term anthropology. Special attention is given by explorers in the service of the museum to the investigation of the antiquities of Yucatan and Central America, of which its publications on Copan, the caves of Loltun, and Labná, have been noticed in the Monthly. These explorations have been continued when and where circumstances made it feasible. Among the gifts acknowledged in the report of the museum are two hundred facsimile copies of the Aztec Codex Vaticanus, from the Duke of Loubat, an original Mexican manuscript of 1531, on agave paper, from the Mary Hemenway estate; the extensive private archæological collection of Mr. George W. Hammond; articles from Georgia mounds, from Clarence B. Moore, and other gifts of perhaps less magnitude but equal interest. Mr. Andrew Gibb, of Edinburgh, has given five pieces of rudely made pottery from the Hebrides, which were made several years ago by a woman who is thought to have been the last one to make pottery according to the ancient method of shaping the clay with the hands, and without the use of any form of potter's wheel. Miss Maria Whitney, sister of the late Prof. J. D. Whitney, has presented the "Calaveras skull" and the articles found with it, and all the original documents relating to its discovery and history. Miss Phebe Ferris, of Madisonville, Ohio, has bequeathed to the museum about twenty-five acres of land, on which is situated the ancient mound where Dr. Metz and Curator Putnam have investigated for several years, and whence a considerable collection has been obtained. Miss Ferris expressed the desire that the museum continue the explorations, and after completing convert the tract into a public park. Mr. W. B. Nicker has explored some virgin mounds near Galena, Ill., and a rock shelter and stone grave near Portage, Ill. The library of the museum now contains 1,838 volumes and 2,479 pamphlets on anthropology.

Correspondence.

DO ANIMALS REASON?

Editor Popular Science Monthly:

DEAR SIR: In connection with the discussion of the interesting subject Do Animals Reason? permit me to relate the following incident in support of the affirmative side of the question:

Some years ago, before the establishment of the National Zoölogical Park in this city, Dr. Frank Baker, the curator, kept a small nucleus of animals in the rear of the National Museum; among this collection were several monkeys. On a hot summer day, as I was passing the monkey cage I handed to one of the monkeys a large piece of fresh molasses taffy. The animal at once carried it to his mouth and commenced to bite it. The candy was somewhat soft, and stuck to the monkey's paws. He looked at his paws, licked them with his tongue, and then turned his head from side to side looking about the cage. Then, taking the candy in his mouth, he sprang to the farther end of the cage and picked up a wad of brown paper. This ball of paper he carefully unfolded, and, laying it down on the floor of the cage, carefully smoothed out the folds of the paper with both paws. After he had smoothed it out to his satisfaction, he took the piece of taffy from his mouth and laid it in the center of the piece of paper and folded the paper over the candy, leaving a part of it exposed. He then sat back on his haunches and ate the candy, first wiping one paw and then the other on his hip, just as any boy or man might do.

If that monkey did not show reason, what would you call it?

Yours etc., H. O. HALL,
Library Surgeon General's Office, United States Army.

WASHINGTON, D. C., *October 2, 1899.*

Editor's Table.

HOME BURDENS.

THE doctrine has gone abroad, suggested by the most popular poet of the day, that "white men" have the duty laid upon them of scouring the dark places of the earth for burdens to take up. Through a large part of this nation the idea has run like wildfire, infecting not a few who themselves are in no small degree burdens to the community that shelters them. The rowdier element of the population everywhere is strongly in favor of the new doctrine, which to their minds is chiefly illustrated by the shooting of Filipinos. We do not say that thousands of very respectable citizens are not in favor of it also; we only note that they are strongly supported by a class whose adhesion adds no strength to their cause.

It is almost needless to remark that a very few years ago we were not in the way of thinking that the civilized nations of the earth, which had sliced up Asia and Africa in the interest of their trade, had done so in the performance of a solemn duty. The formula "the white man's burden" had not been invented then, and some of us used to think that there was more of the filibustering spirit than of a high humanitarianism in these raids upon barbarous races. Possibly we did less than justice to some of the countries concerned, notably Great Britain, which, having a teeming population in very narrow confines, and being of old accustomed to adventures by sea, had naturally been led to extend her influence and create outlets for her trade in distant parts of the earth. Be this as it may, we seemed to have our own

work cut out for us at home. We had the breadth of a continent under our feet, rich in the products of every latitude; we had unlimited room for expansion and development; we had unlimited confidence in the destinies that awaited us as a nation, if only we applied ourselves earnestly to the improvement of the heritage which, in the order of Providence, had become ours. We thanked Heaven that we were not as other nations, which, insufficiently provided with home blessings, were tempted to put forth their hands and—steal, or something like it, in heathen lands.

Well, we have changed all that: we give our sympathy to the nations of the Old World in their forays on the heathen, and are vigorously tackling "the white man's burden" according to the revised version. It is unfortunate and quite unpleasant that this should involve shooting down people who are only asking what our ancestors asked and obtained—the right of self-government in the land they occupy. Still, we must do it if we want to keep up with the procession we have joined. Smoking tobacco is not pleasant to the youth of fifteen or sixteen who has determined to line up with his elders in that manly accomplishment. He has many a sick stomach, many a flutter of the heart, before he breaks himself into it; but, of course, he perseveres—has he not taken up the white boy's burden? So we. Who, outside of that rowdy element to which we have referred, has not been, whether he has confessed it or not, sick at heart at the thought of the innocent blood we have shed and of the blood of our kindred that we have shed in order to shed that blood? Still, spite of all misgivings and qualms, we hold our course, Kipling leading on, and the colonel of the Rough Riders assuring us that it is all right.

Revised versions are not always the best versions; and for our own part we prefer to think that the true "white man's burden" is that which lies at his own door, and not that which he has to compass land and sea to come in sight of. We have in this land the burden of a not inconsiderable tramp and hoodlum population. This is a burden of which we can never very long lose sight; it is more or less before us every day. It is a burden in a material sense, and it is a burden in what we may call a spiritual sense. It impairs the satisfaction we derive from our own citizenship, and it lies like a weight on the social conscience. It is the opprobrium alike of our educational system and of our administration of the law. How far would the national treasure and individual energy which we have expended in failing to subdue the Filipino "rebels" have gone—if wisely applied—in subduing the rebel elements in our own population, and rescuing from degradation those whom our public schools have failed to civilize? Shall the reply be that we can not interfere with individual liberty? It would be a strange reply to come from people who send soldiers ten thousand miles away for the express purpose of interfering with liberty as the American nation has always hitherto understood that term; but, in point of fact, there is no question of interfering with any liberty that ought to be respected. It is a question of the protection of public morals, of public decency, and of the rights of property. It is a question of the rescue of human beings — our fellow-citizens — from ignorance, vice, and wretchedness. It is a question of making us as a nation right with ourselves, and making citizenship under our flag something to be prized by every one entitled to claim it.

It is not in the cities only that

undesirable elements cluster. The editor of a lively little periodical, in which many true things are said with great force—The Philistine—has lately declared that his own village, despite the refining influences radiated from the "Roycroft Shop," could furnish a band of hoodlum youths that could give points in every form of vile behavior to any equal number gathered from a great city. He hints that New England villages may be a trifle better, but that the farther Western States are decidedly worse. It is precisely in New England, however, that a bitter cry on this very subject of hoodlumism has lately been raised. What are we to do about it?

Manifestly the hoodlum or incipient tramp is one of two things: either he is a person whom a suitable education might have turned into some decent and honest way of earning a living, or he is a person upon whom, owing to congenital defect, all educational effort would have been thrown away. In either case social duty seems plain. If education would have done the work, society—seeing that it has taken the business of public education in hand—should have supplied the education required for the purpose, even though the amount of money available for waging war in the Philippines had been slightly reduced. If the case is one in which no educational effort is of avail, then, as the old Roman formula ran, "Let the magistrates see that the republic takes no harm." Before, therefore, our minds can be easy on this hoodlum question, we must satisfy ourselves thoroughly that our modes of education are not, positively or negatively, adapted to making the hoodlum variety of character. The hoodlum, it is safe to say, is an individual in whom no intellectual interest has ever been awakened, in whom no special capacity has ever been created. His moral nature has never been taught to respond to any high or even respectable principle of conduct. If there is any glory in earth or heaven, any beauty or harmony in the operations of natural law, any poetry or pathos or dignity in human life, anything to stir the soul in the records of human achievement, to all such things he is wholly insensible. Ought this to be so in the case of any human being, not absolutely abnormal, whom the state has undertaken to educate? If, as a community, we put our hands to the educational plow, and so far not only relieve parents of a large portion of their sense of responsibility, but actually suppress the voluntary agencies that would otherwise undertake educational work, surely we should see to it that our education educates. Direct moral instruction in the schools is not likely to be of any great avail unless, by other and indirect means, the mind is prepared to receive it. What is needed is to awaken a sense of capacity and power, to give to each individual some trained faculty and some direct and, as far as it goes, scientific cognizance of things. Does any one suppose that a youth who had gone through a judicious course of manual training, or one who had become interested in any such subject as botany, chemistry, or agriculture, or who even had an intelligent insight into the elementary laws of mechanics, could develop into a hoodlum? On the other hand, there is no difficulty in imagining that such a development might take place in a youth who had simply been plied with spelling-book, grammar, and arithmetic. Even what seem the most interesting reading lessons fall dead upon minds that have no hold upon the reality of things, and no sense of the distinctions which the most elementary study of Nature forces on the attention.

But, as we have admitted, there may be cases where the nature of the individual is such as to repel all effort for its improvement. Here the law must step in, and secure the community against the dangers to which the existence of such individuals exposes it. There is a certain element in the population which wishes to live, and is determined to live, on a level altogether below anything that can be called civilization. Those who compose it are nomadic and predatory in their habits, and occasionally give way to acts of fearful criminality. It is foolish not to recognize the fact, and take the measures that may be necessary for the isolation of this element. To devise and execute such measures is a burden a thousand times better worth taking up than the burden of imposing our yoke upon the Philippine Islands and crushing out a movement toward liberty quite as respectable, to all outward appearance, as that to which we have reared monuments at Bunker Hill and elsewhere. The fact is, the work before us at home is immense; and it is work which we might attack, not only without qualms of conscience, but with the conviction that every unit of labor devoted to it was being directed toward the highest interests not of the present generation only, but of generations yet unborn. The "white man," we trust, will some day see it; but meanwhile valuable time is being lost, and the national conscience is being lowered by the assumption of burdens that are *not* ours, whatever Mr. Kipling may have said or sung, or whatever Governor Roosevelt may assert on his word as a soldier.

SPECIALIZATION.

THAT division of labor is as necessary in the pursuit of science as in the world of industry no one would think of disputing; but that, like division of labor elsewhere, it has its drawbacks and dangers is equally obvious. When the latter truth is insisted on by those who are not recognized as experts, the experts are apt to be somewhat contemptuous in resenting such interference, as they consider it. An expert himself has, however, taken up the parable, and his words merit attention. We refer to an address delivered by Prof. J. Arthur Thompson, at the University of Aberdeen, upon entering on his duties as Regius Professor of Natural History, a post to which he was lately appointed. "We need to be reminded," he said, "amid the undoubted and surely legitimate fascinations of dissection and osteology, of section cutting and histology, of physiological chemistry and physiological physics, of embryology and fossil hunting, and the like, that the chief end of our study is a better understanding of living creatures in their natural surroundings." He could see no reason, he went on to say, for adding aimlessly to the overwhelming mass of detail already accumulated in these and other fields of research. The aim of our efforts should rather be to grasp the chief laws of growth and structure, and to rise to a true conception of the meaning of organization.

The tendency to over-specialization is manifest everywhere; it may be traced in physics and chemistry, in mathematics, in archæology, and in philology, as well as in biology. We can not help thinking that there is a certain narcotic influence arising from the steady accumulation of minute facts, so that what was in the first place, and in its early stages, an invigorating pursuit becomes not only an absorbing, but more or less a benumbing passion. We are accustomed to profess great admiration for Browning's Grammarian, who—

"Gave us the doctrine of the enclitic *De*
Dead from the waist down,"

but really we don't feel quite sure that the cause for which the old gentleman struggled was quite worthy of such desperate heroism. The world could have got along fairly well for a while with an imperfect knowledge of the subtle ways of the "enclitic *De*," and indeed a large portion of the world has neither concerned itself with the subject nor felt the worse for not having done so.

What we fear is that some people are "dead from the waist down," or even from higher up, without being aware of it, and all on account of a furious passion for "enclitic de's" or their equivalent in other lines of study. Gentlemen, it is not worth while! You can not all hope to be buried on mountain tops like the grammarian, for there are not peaks enough for all of you, and any way what good would it do you? There is need of specialization, of course; we began by saying that the drift of our remarks is simply this, that he who would go into minute specializing should be careful to lay in at the outset a good stock of common sense, a liberal dose (if he can get it) of humor, and *quantum suff.* of humanity. Thus provided he can go ahead.

Scientific Literature.

SPECIAL BOOKS.

The comparison between the United States in 1790 and Australia in 1891, with which Mr. *A. F. Weber* opens his essay on *The Growth of Cities in the Nineteenth Century*,* well illustrates how the tendency of population toward agglomeration in cities is one of the most striking social phenomena of the present age. Both countries were in nearly a corresponding state of development at the time of bringing them into the comparison. The population of the United States in 1790 was 3,929,214; that of Australia in 1891 was 3,809,895; while 3.14 per cent of the people of the United States were then living in cities of ten thousand or more inhabitants, 33.20 per cent of the Australians are now living in such cities. Similar conditions or the tendency toward them are evident in nearly every country of the world. What are the forces that have produced the shifting of population thus indicated; what the economic, moral, political, and social consequences of it; and what is to be the attitude of the publicist, the statesman, and the teacher toward the movement, are questions which Mr. Weber undertakes to discuss. The subject is a very complicated and intricate one, with no end of puzzles in it for the careless student, and requiring to be viewed in innumerable shifting lights, showing the case in changing aspects; for in the discussion lessons are drawn by the author from every country in the family of nations. Natural causes—variations in climate, soil, earth formation, political institutions, etc.—partly explain the distribution of population, but only partly. It sometimes contradicts what would be deduced from them. Increase and improvement in facilities for communication help the expansion of commercial and industrial centers,

* The Growth of Cities in the Nineteenth Century. A Study in Statistics. By Adna Ferrin Weber. (Columbia University Studies in History, Economics, and Public Law.) New York: Published for Columbia University by the Macmillan Company. Pp. 495. Price, $3.50.

but also contribute to the scattering of population over wider areas. The most potent factors in attracting people to the cities were, in former times, the commercial facilities they afforded, with opportunities to obtain employment in trade, and are now the opportunities for employment in trade and in manufacturing industries. The cities, however, do not grow merely by accretions from the outside, but they also enjoy a new element of natural growth within themselves in the greater certainty of living and longer duration of life brought about by improved management and ease of living in them, especially by improved sanitation, and it is only in the nineteenth century that any considerable number of cities have had a regular surplus of births over deaths. Migration cityward is not an economic phenomenon peculiar to the nineteenth century, but is shown by the study of the social statistics and the bills of mortality of the past to have been always a factor important enough to be a subject of special remark. It is, however, a very lively one now, and "in the immediate future we may expect to see a continuation of the centralizing movement; while many manufacturers are locating their factories in the small cities and towns, there are other industries that prosper most in the great cities. Commerce, moreover, emphatically favors the great centers rather than the small or intermediate centers." In examining the structure of city populations, a preponderance of the female sex appears, and is explained by the accentuated liability of men over women in cities to death from dangers of occupation, vice, crime, and excesses of all kinds. There are also present in the urban population a relatively larger number of persons in the active period of life, whence an easier and more animated career, more energy and enterprise, more radicalism and less conservatism, and more vice, crime, and impulsiveness generally may be expected. Of foreign immigrants, the least desirable class are most prone to remain in the great cities; and with the decline of railway building and the complete occupation of the public lands the author expects that immigrants in the future will disperse less readily than in the past, but in the never-tiring energy of American enterprise this may not prove to be the case. As to occupation, the growth of cities is found to favor the development of a body of artisans and factory workmen, as against the undertaker and employer, and "that the class of day laborers is relatively small in the cities is reason for rejoicing." It is found "emphatically true that the growth of cities not only increases a nation's economic power and energy, but quickens the national pulse. . . . A progressive and dynamic civilization implies the good and bad alike. The cities, as the foci of progress, inevitably contain both." The development of suburban life, stimulated by the railroad and the trolley, and the transference of manufacturing industries to the suburbs, are regarded as factors of great promise for the amelioration of the recognized evils of city life and for the solution of some of the difficulties it offers and the promotion of its best results.

Dr. *James K. Crook*, author of *The Mineral Waters of the United States and their Therapeutic Uses*,* accepts it as proved by centuries of experience that in certain disorders the intelligent use of mineral

* Mineral Waters of the United States and their Therapeutic Uses, with an Account of the Various Mineral Spring Localities, their Advantages as Health Resorts, Means of Access, etc.; to which is aided an Appendix on Potable Waters. By James K. Crook. New York and Philadelphia: Lea Brothers & Co. Pp. 588. Price, $3.50.

waters is a more potent curative agency than drugs. He believes that Americans have within their own borders the close counterparts of the best foreign springs, and that in charms of scenery and surroundings, salubrity of climate and facilities for comfort, many of our spas will compare as resorts with the most highly developed ones of Europe. The purpose of the present volume is to set forth the qualities and attractions of American springs, of which we have a large number and variety, and the author has aimed to present the most complete and advanced work on the subject yet prepared. To make it so, he has carefully examined all the available literature on the subject, has addressed letters of inquiry to proprietors and other persons cognizant of spring resorts and commercial springs, and has made personal visits. While a considerable number of the 2,822 springs enumerated by Dr. A. C. Peale in his report to the United States Geological Survey have dropped out through non-use or non-development, more than two hundred mineral-spring localities are here described for the first time in a book of this kind. Every known variety of mineral water is represented. The subject is introduced by chapters on what might be called the science of mineral waters and their therapeutic uses, including the definition, the origin of mineral waters, and the sources whence they are mineralized; the classification, the discussion of their value, and mode of action; their solid and gaseous components; their therapeutics or applications to different disorders; and baths and douches and their medicinal uses. The springs are then described severally by States. The treatise on potable waters in the appendix is brief, but contains much.

GENERAL NOTICES.

In *Every-Day Butterflies* * Mr. *Scudder* relates the story of the very commonest butterflies—"those which every rambler at all observant sees about him at one time or another, inciting his curiosity or pleasing his eye." The sequence of the stories is mainly the order of appearance of the different subjects treated—which the author compares to the flowers in that each kind has its own season for appearing in perfect bloom, both together variegating the landscape in the open season of the year. This order of description is modified occasionally by the substitution of a later appearance for the first, when the butterfly is double or triple brooded. As illustrations are furnished of each butterfly discussed, it is not necessary that the descriptions should be long and minute, hence they are given in brief and general terms. But it must be remembered that the describer is a thorough master of his subject, and also a master in writing the English language, so that nothing will be found lacking in his descriptions. They are literature as well as butterfly history. Of the illustrations, all of which are good, a considerable number are in colors.

* Every-Day Butterflies. A Group of Biographies. By Samuel Hubbard Scudder. Boston and New York: Houghton, Mifflin & Co. Pp. 386. Price, $2.

Dr. *M. E. Gellé's L'Audition et ses Organes* * (The Hearing and its Organs) is a full, not over-elaborate treatise on the subject, in which prominence is given to the physiological side. The first part treats of the excitant of the sense of hearing—sonorous vibrations—including the vibrations themselves, the length of the vibratory phenomena, the intensity of sound, range of audition, tone, and *timbre* of sounds. The second chapter relates to the organs of hearing, both the peripheric organs and the acoustic centers, the anatomy of which is described in detail, with excellent and ample illustrations. The third chapter is devoted to the sensation of hearing under its various aspects—the time

* L'Audition et ses Organes. By Dr. M. E. Gellé. Paris: Félix Alcan (Bibliothèque Scientifique). Pp. 326. Price, six francs.

required for perception, "hearing in school," the influence of habit and attention, orientation of the sound, bilateral sensations, effects on the nervous centers, etc., hearing of musical sounds, oscillations and aberrations of hearing, auditive memory, obsessions, hallucinations of the ear, and colored audition.

Prof. *Andrew C. McLaughlin's History of the American Nation* * has many features to recommend it. It aims to trace the main outlines of national development, and to show how the American people came to be what they are. These outlines involve the struggle of European powers for supremacy in the New World, the victory of England, the growth of the English colonies and their steady progress in strength and self-reliance till they achieved their independence, the development of the American idea of government, its extension across the continent and its influence abroad—all achieved in the midst of stirring events, social, political, and moral, at the cost sometimes of wars, and accompanied by marvelous growth in material prosperity and political power. All this the author sets forth, trying to preserve the balance of the factors, in a pleasing, easy style. Especial attention is paid to political facts, to the rise of parties, to the development of governmental machinery, and to questions of government and administration. In industrial history those events have been selected for mention which seem to have had the most marked effect on the progress and make-up of the nation. It is to be desired that more attention had been given to social aspects and changes in which the development has not been less marked and stirring than in the other departments of our history. Indeed, the field for research and exposition here is extremely wide and almost infinitely varied, and it has hardly yet begun to be worked, and with any fullness only for special regions. When he comes to recent events, Professor McLaughlin naturally speaks with caution and in rather general terms. It seems to us, however, that in the matter of the war with Spain, without violating any of the proprieties, he might have given more emphasis to the anxious efforts of that country to comply with the demands of the administration for the institution of reforms in Cuba; and, in the interest of historical truth, he ought not to have left unmentioned the very important fact that the Spanish Government offered to refer the questions growing out of the blowing up of the Maine to arbitration and abide by the result, and our Government made no answer to the proposition.

Mr. *W. W. Campbell's Elements of Practical Astronomy* * is an evolution. It grew out of the lessons of his experience in teaching rather large classes in astronomy in the University of Michigan, by which he was led to the conclusion that the extensive treatises on the subject could not be used satisfactorily except in special cases. Brief lecture notes were employed in preference. These were written out and printed for use in the author's classes. The first edition of the book made from them was used in several colleges and universities having astronomical departments of high character. The work now appears, slightly enlarged, in a second edition. In the present greatly extended field of practical astronomy numerous special problems arise, which require prolonged efforts on the part of professional astronomers. While for the discussion of the methods employed in solving such problems the reader is referred to special treatises and journals, these methods are all developed from the *elements* of astronomy and the related sciences, of which it is intended that this book shall contain the elements of practical astronomy, with numerous references to the problems first requiring solution. The author believes that the methods of observing employed are illustrations of the best modern practice.

In *The Characters of Crystals* † Prof. *Alfred J. Moses* has attempted to describe, simply and concisely, the meth-

* A History of the American Nation. By Andrew C. McLaughlin. New York: D. Appleton and Company. Pp. 587. Price, $1.40.

* The Elements of Practical Astronomy. By W. W. Campbell. Second edition, revised and enlarged. New York: The Macmillan Company. Pp. 264. Price, $2.

† The Characters of Crystals. An Introduction to Physical Crystallography. By Alfred J. Moses. New York: D. Van Nostrand Company. Pp 211. Price, $2.

ods and apparatus used in studying the physical characters of crystals, and to record and explain the observed phenomena without complex mathematical discussions. The first part of the book relates to the geometrical characteristics of crystals, or the relations and determination of their forms, including the spherical projection, the thirty-two classes of forms, the measurement of crystal angles, and crystal projection or drawing. The optical characters and their determination are the subject of the second part. In the third part the thermal, magnetic, and electrical characters and the characters dependent upon electricity (elastic and permanent deformations) are treated of. A suggested outline of a course in physical crystallography is added, which includes preliminary experiments with the systematic examination of the crystals of any substance, and corresponds with the graduate course in physical crystallography given in Columbia University. The book is intended to be useful to organic chemists, geologists, mineralogists, and others interested in the study of crystals. The treatment is necessarily technical.

A book describing the *Practical Methods of identifying Minerals in Rock Sections with the Microscope* * has been prepared by Mr. *L. McI. Luquer* to ease the path of the student inexperienced in optical mineralogy by putting before him only those facts which are absolutely necessary for the proper recognition and identification of the minerals in thin sections. The microscopic and optical characters of the minerals are recorded in the order in which they would be observed with a petrographical microscope; when the sections are opaque, attention is called to the fact, and the characters are recorded as seen with incident light. The order of Rosenbusch, which is based on the symmetry of the crystalline form, is followed, with a few exceptions made for convenience. In an introductory chapter a practical elementary knowledge of optics as applied to optical mineralogy is attempted to be given, without going into an elaborate discussion of the subject. The petrographical microscope is described in detail. The application of it to the investigation of mineral characteristics is set forth in general and as to particular minerals. The preparation of sections and practical operations are described, and an optical scheme is appended, with the minerals grouped according to their common optical characters.

Mr. *Herbert C. Whitaker's Elements of Trigonometry* * is concise and of very convenient size for use. The introduction and the first five of the seven chapters have been prepared for the use of beginners. The other two chapters concern the properties of triangles and spherical triangles; an appendix presents the theory of logarithms; and a second appendix, treating of goniometry, complex quantities, and complex functions, has been added for students intending to take up work in higher departments of mathematics. For assisting a clearer understanding of the several processes, the author has sought to associate closely with every equation a definite meaning with reference to a diagram. Other characteristics of the book are the practical applications to mechanics, surveying, and other everyday problems; its many references to astronomical problems, and the constant use of geometry as a starting point and standard.

A model in suggestions for elementary teaching is offered in *California Plants in their Homes*,† by *Alice Merritt Davidson*, formerly of the State Normal School, California. The book consists of two parts, a botanical reader for children and a supplement for the use of teachers, both divisions being also published in separate volumes. It is well illustrated, provided with an index and an outline of lessons adapted to different grades. The treatment of each theme is fresh, and the grouping novel, as is indicated by the chapter headings: Some Plants that lead Easy Lives, Plants that know

---

* Minerals in Rock Sections; the Practical Method of identifying Minerals in Rock Sections with the Microscope. Especially arranged for Students in Scientific Schools. By Lea McIlvaine Luquer. New York: D. Van Nostrand Company. Pp. 117.

* Elements of Trigonometry, with Tables. By Herbert C. Whitaker. Philadelphia: Eldredge & Brother. Pp. 200.

† California Plants in their Homes. By Alice Merritt Davidson. Los Angeles, Cal.: B. R. Baumgardt & Co. Pp. 215–133.

how to meet Hard Times, Plants that do not make their own Living, Plants with Mechanical Genius. Although specially designed for the study of the flora of southern California, embodying the results of ten years' observation by the author, it may be recommended to science teachers in any locality as an excellent guide. The pupil in this vicinity will have to forego personal inspection of the shooting-star and mariposa lily, while he finds the century plant, yuccas, and cacti domiciled in the greenhouse. In addition to these, however, attention is directed to a sufficient number of familiar flowers, trees, ferns, and fungi for profitable study, and the young novice in botany can scarcely make a better beginning than in company with this skillful instructor.

Prof. *John M. Coulter's Plant Relations* * is one of two parts of a system of teaching botany proposed by the author. Each of the two books is to represent the work of half a year, but each is to be independent of the other, and they may be used in either order. The two books relate respectively, as a whole, to ecology, or the life relations of surroundings of plants, and to their morphology. The present volume concerns the ecology. While it may be to the disadvantage of presenting ecology first, that it conveys no knowledge of plant structures and plant groups, this disadvantage is compensated for, in the author's view, by the facts that the study of the most evident life relations gives a proper conception of the place of plants in Nature; that it offers a view of the plant kingdom of the most permanent value to those who can give but a half year to botany; and that it demands little or no use of the compound microscope, an instrument ill adapted to first contacts with Nature. The book is intended to present a connected, readable account of some of the fundamental facts of botany, and also to serve as a supplement to the three far more important factors of the teacher, who must amplify and suggest at every point; the laboratory, which must bring the pupil face to face with plants and their structure; and field work, which must relate the facts observed in the laboratory to their actual place in Nature, and must bring new facts to notice which can be observed nowhere else. Taking the results obtained from these three factors, the book seeks to organize them, and to suggest explanations, through a clear, untechnical, compact text and appropriate and excellent illustrations.

The title of *The Wilderness of Worlds* * was suggested to the author by the contemplation of a wilderness of trees, in which those near him are very large, while in the distance they seem successively smaller, and gradually fade away till the limit of vision is reached. So of the wilderness of worlds in space, with its innumerable stars of gradually diminishing degrees of visibility—worlds "of all ages like the trees, and the great deep of space is covered with their dust, and pulsating with the potency of new births." The body of the book is a review of the history of the universe and all that is of it, in the light of the theory of evolution, beginning with the entities of space, time, matter, force, and motion, and the processes of development from the nebulæ as they are indicated by the most recent and best verified researches, and terminating with the ultimate extinction of life and the end of the planet. In the chapter entitled A Vision of Peace the author confronts religion and science. He regards the whole subject from the freethinker's point of view, with a denial of all agency of the supernatural.

In a volume entitled *The Living Organism* † Mr. *Alfred Earl* has endeavored to make a philosophical introduction to the study of biology. The closing paragraph of his preface is of interest as showing his views regarding vitalism: "The object of the book will be attained if it succeeds, although it may be chiefly by negative criticism, in directing attention to the important truth that, though chemical and physical changes enter

* Plant Relations. A First Book of Botany. By John M. Coulter. New York: D. Appleton and Company. (Twentieth Century Text Books.) Pp. 264. Price, $1.10.

* The Wilderness of Worlds. A Popular Sketch of the Evolution of Matter from Nebula to Man and Return. The Life-Orbit of a Star. By George W. Morehouse. New York: Peter Eckler. Pp. 246. Price, $1.

† The Living Organism. By Alfred Earl, M. A. New York: The Macmillan Company. Pp. 271. Price, $1.75.

largely into the composition of vital activity, there is much in the living organism that is outside the range of these operations." The first three chapters discuss general conceptions, and are chiefly psychology. A discussion of the structures accessory to alimentation in man and the higher animals occupies Chapters IV and V. The Object of Classification, Certain General Statements concerning Organisms, A Description of the Organism as related to its Surroundings, The Material Basis of Life, The Organism as a Chemical Aggregate and as a Center for the Transformation of Energy, Certain Aspects of Form and Development, The Meaning of Sensation, and, finally, Some of the Problems presented by the Organism, are the remaining chapter headings. The volume contains many interesting suggestions, and might perhaps most appropriately be described as a Theoretical Biology.

"*Stars and Telescopes,*" * Professor *Todd* says, "is intended to meet an American demand for a plain, unrhetorical statement of the astronomy of to-day." We might state the purpose to be to bring astronomy and all that pertains to it up to date. It is hard to do this, for the author has been obliged to put what was then the latest discovery, made while the book was going through the press, in a footnote at the end of the preface. The information embodied in the volume is comprehensive, and is conveyed in a very intelligible stylé. The treatise begins with a running commentary or historical outline of astronomical discovery, with a rigid exclusion of all detail. The account of the earth and moon is followed by chapters on the Calendar and the Astronomical Relations of Light. The other members of the solar system are described and their relations reviewed, and then the comets and the stars. Closely associated with these subjects are the men who have contributed to knowledge respecting them, and consequently the names of the great discoverers and others who have helped in the advancement of astronomy are introduced in immediate connection with their work, in brief sketches and often with their portraits. Much importance is attributed by Professor Todd to the instruments with which astronomical discovery is carried on, and the book may be said to culminate in an account of the famous instruments, their construction, mounting, and use. The devisers of these instruments are entitled to more credit than the unthinking are always inclined to give them, for the value of an observation depends on the accuracy of the instrument as well as on the skill of the observer, and the skill which makes the instrument accurate is not to be underrated. So the makers of the instruments are given their place. Then the recent and improved processes have to be considered, and, altogether, Professor Todd has found material for a full and somewhat novel book, and has used it to good advantage.

* Stars and Telescopes. A Handbook of Popular Astronomy. Boston: Little, Brown & Co. Pp. 419. Price, $2.

Some Observations on the Fundamental Principles of Nature is the title of an essay by *Henry Witt*, which, though very brief, takes the world of matter, mind, and society within its scope. One of the features of the treatment is that instead of the present theory of an order of things resulting from the condensation of more rarefied matter, one of the organization of converging waves of infinitesimal atoms filling all space is substituted. With this point prominently in view, the various factors and properties of the material universe—biology, psychology, sociology, ethics, and the future—are treated of.

Among the later monographs published by the Field Columbian Museum, Chicago, is a paper in the Geological Series (No. 3) on *The Ores of Colombia, from Mines in Operation in 1892*, by *H. W. Nichols*. It describes the collection prepared for the Columbian Exposition by F. Pereira Gamba and afterward given to the museum—a collection which merits attention for the light it throws upon the nature and mode of occurrence of the ores of one of the most important gold-producing countries of the world, and also because it approaches more nearly than is usual the ideal of what a collection in economic geology should be. Other publications in the museum's Geological Series are *The Mylagaulidæ, an Extinct Family of Sciuromorph Rodents* (No. 4), by *E. S. Riggs*, describing some squirrel-like animals from the Deep River beds, near White

Sulphur Springs, Montana; *A Fossil Egg from South Dakota* (No. 5), by *O. C. Farrington*, relative to the egg of an anatine bird from the early Miocene; and *Contributions to the Paleontology of the Upper Cretaceous Series* (No. 6), by *W. N. Logan*, in which seven species of *Scaphites, Ostrea, Gasteropoda*, and corals are described. In the Zoölogical Series, *Preliminary Descriptions of New Rodents from the Olympic Mountains* (of Washington) (No. 11), by *D. G. Elliot*, relates to six species; *Notes on a Collection of Cold-blooded Vertebrates from the Olympic Mountains* (No. 12), by *S. E. Meek*, to six trout and three other fish, four amphibia, and three reptiles; and a *Catalogue of Mammals from the Olympic Mountains, Washington*, with descriptions of new species (No. 13), by *D. G. Elliot*, includes a number of species of rodents, lynx, bear, and deer.

Some Notes on Chemical Jurisprudence is the title given by *Harwood Huntington* (260 West Broadway, New York; 25 cents) to a brief digest of patent-law cases involving chemistry. The notes are designed to be of use to chemists intending to take out patents by presenting some of the difficulties attendant upon drawing up a patent strong enough to stand a lawsuit, and by explaining some points of law bearing on the subject. In most, if not all, cases where the chemist has devised a new method or application it is best, the author holds, to take out a patent for self-protection, else the inventor may find his device stolen from him and patented against him.

A cave or fissure in the Cambrian limestone of Port Kennedy, Montgomery County, Pa., exposed by quarrymen the year before, was brought to the knowledge of geologists by Mr. Charles M. Wheatley in 1871, when the fossils obtained from it were determined by Prof. E. D. Cope as of thirty-four species. Attention was again called to the paleontological interest of the locality by President Dixon, of the Academy of Natural Sciences of Philadelphia, in 1894. The fissure was examined again by Dr. Dixon and others, and was more thoroughly explored by Mr. Henry C. Mercer. Mr. Mercer published a preliminary account of the work, which was followed by the successive studies of the material by Professor Cope preliminary to a complete and illustrated report to be made after a full investigation of all accessible material. Professor Cope did not live to publish this full report, which was his last work, prepared during the suffering of his final illness. It is now published, just as the author left it, as *Vertebrate Remains from the Port Kennedy Deposit*, from the Journal of the Academy of Natural Sciences of Philadelphia. Four plates of illustrations, photographed from the remains, accompany the text.

The machinery of Mr. *Fred A. Lucas's* story of *The Hermit Naturalist* reminds us of that of the old classical French romances, like Télémaque, and the somewhat artificial, formal diction is not dissimilar. An accident brings the author into acquaintance and eventual intimacy with an old Sicilian naturalist, who, migrating to this country, has established a home, away from the world's life, on an island in the Delaware River. The two find a congenial subject of conversation in themes of natural history, and the bulk of the book is in effect a running discourse by the old Sicilian on snakes and their habits—a valuable and interesting lesson. The hermit has a romance, involving the loss of his motherless daughter, stolen by brigands and brought to America, his long search for her and resignation of hope, and her ultimate discovery and restoration to him. The book is of easy reading, both as to its natural history and the romance.

We have two papers before us on the question of expansion. One is an address delivered by John Barrett, late United States Minister to Siam, before the Shanghai General Chamber of Commerce, and previous to the beginning of the attempt to subjugate the islands, on *The Philippine Islands and American Interests in the Far East*. This address has, we believe, been since followed by others, and in all Mr. Barrett favors the acquisition of the Philippine Islands on the grounds, among others, of commercial interests and the capacity of the Filipinos for development in further civilization and self-government; but his arguments, in the present aspect of the Philippine question, seem to us to bear quite as decidedly in the opposite direction. He gives the following picture of Aguinaldo and the Filipino govern-

ment: "He (Aguinaldo) captured all Spanish garrisons on the island of Luzon outside of Manila, so that when the Americans were ready to proceed against the city they were not delayed and troubled with a country campaign. Moreover, he has organized a government which has practically been administering the affairs of the great island since the American occupation of Manila, and which is certainly better than the former administration; he has a properly formed Cabinet and Congress, the members of which, in appearance and manners, would compare favorably with Japanese statesmen. He has among his advisers men of ability as international lawyers, while his supporters include most of the prominent educated and wealthy natives, all of which prove possibilities of self-government that we must consider." This pamphlet is published at Hong Kong. The other paper is an address delivered before the New York State Bar Association, by *Charles A. Gardiner*, on *Our Right to acquire and hold Foreign Territory*, and is published by G. P. Putnam's Sons in the Questions of the Day Series. Mr. Gardiner holds and expresses the broadest views of the constitutional power of our Government to commit the acts named, and to exercise all the attributes incidental to the possession of acquired territory, but he thinks that we need a great deal of legal advice in the matter.

A pamphlet, *Anti-Imperialism*, by *Morrison L. Swift*, published by the Public Ownership Review, Los Angeles, Cal., covers the subject of English and American aggression in three chapters—Imperialism to bless the Conquered, Imperialism for the Sake of Mankind, and Our Crime in the Philippines. Mr. Swift is very earnest in respect to some of the subjects touched upon in his essays, and some persons may object that he is more forcible—even to excess—than polite in his denunciations. To such he may perhaps reply that there are things which language does not afford words too strong to characterize fitly.

Among the papers read at the Fourth International Catholic Scientific Congress, held at Fribourg, Switzerland, in August, 1897, was one by *William J. D. Croke* on *Architecture, Painting, and Printing at Subiaco* as represented in the Abbey at Subiaco. The author regards the features of the three arts represented in this place as evidence that the record of the activity of the foundation constitutes a real chapter in the history of progress in general and of culture in particular.

PUBLICATIONS RECEIVED.

Benson, E. F. Mammon & Co. New York: D. Appleton and Company. Pp. 360. $1.50.

Buckley, James A. Extemporaneous Oratory. For Professional and Amateur Speakers. New York: Eaton & Mains. Pp. 480. $1.50.

Canada, Dominion of, Experimental Farms: Reports for 1897. Pp. 449; Reports for 1898. Pp. 429.

Conn, H. W. The Story of Germ Life. (Library of Useful Stories.) New York: D. Appleton and Company. Pp. 199. 40 cents.

Dana, Edward S. First Appendix to the Sixth Edition of Dana's Mineralogy. New York: John Wiley & Sons. Pp. 75. $1.

Franklin Institute, The, Drawing School, also School of Elementary Mathematics: Announcements. Pp. 4 each.

Ganong, William F. The Teaching Botanist. New York: The Macmillan Company. Pp. 270. $1.10.

Getman, F. H. The Elements of Blowpipe Analysis. New York: The Macmillan Company. Pp. 77. 60 cents.

Halliday, H. M. An Essay on the Common Origin of Light, Heat, and Electricity. Washington, D. C. Pp. 46.

Hardin, Willett L. The Rise and Development of the Liquefaction of Gases. New York: The Macmillan Company. Pp. 250. $1.10.

Hillegas, Howard C. Oom Paul's People. A Narrative of the British-Boer Troubles in South Africa, with a History of the Boers, the Country, and its Institutions. New York: D. Appleton and Company. Pp. 308. $1.50.

Ireland, Alleyne. Tropical Colonization. An Introduction to the Study of the Subject. New York: The Macmillan Company. $2.

Kingsley, J. S. Text-Book of Elementary Zoölogy. New York: Henry Holt & Co. Pp. 439.

Knerr, E. B. Relativity in Science. Silico-Barite Nodules from near Salina. Concretions. (Transactions of the Kansas Academy of Science.) Pp. 24.

Krōmskōp Color Photography. Philadelphia: Ives Krōmskōp. Pp. 24.

Liquid-Air Power and Automobile Company. Prospectus. Pp. 16.

MacBride, Thomas A. The North American Slime Molds. Being a List of Species of Myxomycetes hitherto described from North America, including Central America. New York: The Macmillan Company. Pp. 231, with 18 plates. $2.25.

Meyer, A. B. The Distribution of the Negritos in the Philippine Islands and Elsewhere. Dresden (Saxony): Stengel & Co. Pp. 92.

Nicholson, H. H., and Avery, Samuel. Laboratory Exercises with Outlines for the Study of Chemistry, to accompany any Elementary Text. New York: Henry Holt & Co. Pp. 134. 60 cents.

Scharff, R. F. The History of the European Fauna. New York: Imported by Charles Scribner's Sons. Pp. 354. $1.50.

Schleicher, Charles, and Schull, Duren. Rhenish Prussia. Samples of Special Filtering Papers. New York: Eimer & Amend, agents.

Sharpe, Benjamin F. An Advance in Measuring and Photographing Sounds. United States Weather Bureau. Pp. 18, with plates.

Shinn, Milicent W. Notes on the Development of a Child. Parts III and IV. (University of California Studies.) Pp. 224.

Shoemaker, M. M. Quaint Corners of Ancient Empires, Southern India, Burmah, and Manila. New York: G. P. Putnam's Sons. Pp. 212.

Smith, Orlando J. A Short View of Great Questions. New York: The Brandur Company, 220 Broadway. Pp. 75.

Smith, Walter. Methods of Knowledge. An Essay in Epistemology. New York: The Macmillan Company. Pp. 340. $1.25.

Southern, The, Magazine. Monthly. Vol. I, No. 1. August, 1899. Pp. 203. 10 cents. $1 a year.

Suter, William N. Handbook of Optics. New York: The Macmillan Company. Pp. 209. $1.

Tarde, G. Social Laws. An Outline of Sociology. With a Preface by James Mark Baldwin. New York: The Macmillan Company. Pp. 213. $1.25.

Uline, Edwin B. Higinbothamia. A New Genus, and other New Dioscoreaceæ, New Amaranthaceæ. (Field Columbian Museum, Chicago Botanical Series.) Pp. 12.

Underwood, Lucien M. Molds, Mildews, and Mushrooms. New York: Henry Holt & Co. Pp. 227, with 9 plates. $1.50.

United States Civil-Service Commission. Fifteenth Report, July 1, 1897, to June 30, 1898. Pp. 736. Washington.

Fragments of Science.

The Dover Meeting of the British Association.—While the attendance on the meeting of the British Association at Dover was not large—the whole number of members being 1,403, of whom 127 were ladies—the occasion was in other respects eventful and one of marked interest. The papers read were, as a rule, of excellent quality, and the interchange of visits with the French Association was a novel feature that might bear many repetitions. The president, Sir Michael Foster, presented, in his inaugural address, a picture of the state of science one hundred years ago, illustrating it by portraying the conditions to which a body like the association meeting then at Dover would have found itself subject, and suggesting the topics it would have discussed. The period referred to was, however, that of the beginning of the present progress, and, after remarking on what had been accomplished in the interval, the speaker drew a very hopeful foreview for the future. Besides the intellectual triumphs of science, its strengthening discipline, its relation to politics, and the "international brotherhood of science" were brought under notice in the address. In his address as president of the Physical Section, Prof. J. H. Poynting showed how physicists are tending toward a general agreement as to the nature of the laws in which they embody their discoveries, of the explanations they give, and of the hypotheses they make, and, having considered what the form and terms of this agreement should be, passed to a discussion of the limitations of physical science. The subject of Dr. Horace T. Brown's Chemical Section address was The Assimilation of Carbon by the Higher Plants. Sir William H. White, president of the Section of Mechanical Science, spoke on Steam Navigation at High Speeds. President Adam Sedgwick addressed the Zoölogical Section on Variation and some Phenomena connected with Reproduction and Sex; Sir John Murray, the Geographical Section on The Ocean Floor; and Mr. J. N. Langley, the Physiological Section on the general relations of the motor nerves to the several tissues of the body, especially of those which run to tissues over which we have little or no control. The president of the Anthropological Section, Mr. C. H. Read, of the British Museum, spoke of the preservation and proper exploration of the prehistoric antiquities of the country, and offered a plan for increasing the amount of work done in an-

thropological investigation by the use of Government aid. A peculiar distinction attaches to this meeting through its reception and entertainment of the French Association, and the subsequent return of the courtesy by the latter body at Boulogne. About three hundred of the French Associationists, among whom were many ladies, came over, on the Saturday of the meeting, under the lead of their president, M. Brouardel, and accompanied by a number of men of science from Belgium. They were met at the pier by the officers of the British Association, and were escorted to the place of meeting and to the sectional meetings toward which their several tastes directed them. The geological address of Sir Archibald Geikie on Geological Time had been appointed for this day out of courtesy to the French geologists, and in order that they might have an opportunity of hearing one of the great lights of British science. Among the listeners who sat upon the platform were M. Gosselet, president of the French Geological Society; M. Kemna, president of the Belgian Geological Society; and M. Rénard, of Ghent. Public evening lectures were delivered on the Centenary of the Electric Current, by Prof. J. A. Fleming, and (in French) on Nervous Vibration, by Prof. Charles Richet. Sir William Turner was appointed president for the Bradford meeting of the association (1900). The visit of the French Association was returned on September 22d, when the president, officers, and about three hundred members went to Boulogne. They were welcomed by the mayor of the city, the prefect of the department, and a representative of the French Government; were feasted by the municipality of Boulogne; were entertained by the members of the French Association; and special commemorative medals were presented by the French Association to the two presidents. The British visitors also witnessed the inauguration of a tablet in memory of Dr. Duchesne, and of a plaque commemorative of Thomas Campbell, the poet, who died in Boulogne.

Artificial India Rubber.—A recent issue of the Kew Gardens Bulletin contains an interesting article on Dr. Tilden's artificial production of India rubber. India rubber, or caoutchouc, is chemically a hydrocarbon, but its molecular constitution is unknown. When decomposed by heat it is broken up into simpler hydrocarbons, among which is a substance called isoprene, a volatile liquid boiling at about 36° C. Its molecular formula is C_5H_8. Dr. Tilden obtained this same substance (isoprene) from oil of turpentine and other terpenes by the action of moderate heat, and then by treating the isoprene with strong acids succeeded, by means of a very slow reaction, in converting a small portion of it into a tough elastic solid, which seems to be identical in properties with true India rubber. This artificial rubber, like the natural, seems to consist of two substances, one of which is more soluble in benzene and carbon bisulphide than the other. It unites with sulphur in the same way as ordinary rubber, forming a tough, elastic compound. In a recent letter Professor Tilden says: "As you may imagine, I have tried everything I can think of as likely to promote this change, but without success. The polymerization proceeds *very* slowly, occupying, according to my experience, several years, and all attempts to hurry it result in the production not of rubber, but of 'colophene,' a thick, sticky oil quite useless for all purposes to which rubber is applied."

Dangers of High Altitudes for Elderly People.—"The public, and sometimes the inexperienced physician—inexperienced not in general therapeutics but in the physiological effects of altitude on a weak heart," says Dr. Findlater Zangger in the Lancet, "make light of a danger they can not understand. But if an altitude of from four thousand to five thousand feet above the sea level puts a certain amount of strain on a normal heart and by a rise of the blood-pressure indirectly also on the small peripheral arteries, must not this action be multiplied in the case of a heart suffering from even an early stage of myocarditis or in the case of arteries with thickened or even calcified walls? It is especially the rapidity of the change from one altitude to another, with differences of from three thousand to four thousand feet, which must be

considered. There is a call made on the contractibility of the small arteries on the one hand, and on the amount of muscular force of the heart on the other hand, and if the structures in question can not respond to this call, rupture of an artery or dilatation of the heart may ensue. In the case of a normal condition of the circulatory organs little harm is done beyond some transient discomfort, such as dizziness, buzzing in the ears, palpitation, general *malaise*, and this often only in the case of people totally unaccustomed to high altitudes. For such it is desirable to take the high altitude by degrees in two or three stages, say first stage 1,500 feet, second stage from 2,500 to 3,000 feet, and third stage from 4,000 to 6,000 feet, with a stay of one or two days at the intermediate places. The stay at the health resort will be shortened, it is true, but the patient will derive more benefit. On the return journey one short stay at one intermediate place will suffice. Even a fairly strong heart will not stand an overstrain in the first days spent at a high altitude. A Dutch lady, about forty years of age, who had spent a lifetime in the lowlands, came directly up to Adelboden (altitude, 4,600 feet). After two days she went on an excursion with a party up to an Alp 7,000 feet high, making the ascent quite slowly in four hours. Sudden heart syncope ensued, which lasted the best part of an hour, though I chanced to be near and could give assistance, which was urgently needed. The patient recovered, but derived no benefit from a fortnight's stay, and had to return to the low ground the worse for her trip and her inconsiderate enterprise. Rapid ascents to a high altitude are very injurious to patients with arterio-sclerosis, and the mountain railways up to seven thousand and ten thousand feet are positively dangerous to an unsuspecting public, for many persons between the ages of fifty-five and seventy years consider themselves to be hale and healthy, and are quite unconscious of having advanced arterio-sclerosis and perchance contracted kidney. An American gentleman, aged fifty-eight years, was under my care for slight symptoms of angina pectoris, pointing to sclerosis of the coronary arteries. A two-months' course of treatment at Zurich with massage, baths, and proper exercise and diet did away with all the symptoms. I saw him by chance some months later. 'My son is going to St. Moritz (six thousand feet) for the summer,' said he; 'may I go with him?' 'Most certainly not,' was my answer. The patient then consulted a professor, who allowed him to go. Circumstances, however, took him for the summer to Sachseln, which is situated at an altitude of only two thousand feet, and he spent a good summer. But he must needs go up the Pilatus by rail (seven thousand feet), relying on the professor's permission, and the result was disastrous, for he almost died from a violent attack of angina pectoris on the night of his return from the Pilatus, and vowed on his return to Zurich to keep under three thousand feet in future. I may here mention that bad results in the shape of heart collapse, angina pectoris, cardiac asthma, and last, not least, apoplexy, often occur only on the return to the lowlands."

The Parliamentary Amenities Committee.—Under the above rather misleading title there was formed last year, in the English Parliament, a committee for the purpose of promoting concerted action in the preservation and protection of landmarks of general public interest, historic buildings, famous battlefields, and portions of landscape of unusual scenic beauty or geological conformation, and also for the protection from entire extinction of the various animals and even plants which the spread of civilization is gradually pushing to the wall. In reality, it is an official society for the preservation of those things among the works of past man and Nature which, owing to their lack of direct money value, are in danger of destruction in this intensely commercial age. Despite the comparative newness of the American civilization, there are already many relics belonging to the history of our republic whose preservation is very desirable, as well as very doubtful, if some such public-spirited committee does not take the matter in hand; and, as regards the remains of the original Americans, in which the country abounds, the necessity is still more immediate. The official care of Nature's own curiosities is equally needed, as witness the way in

which the Hudson River palisades are being mutilated, and the constant raids upon our city parks for speedways, parade grounds, etc. The great value of a parliamentary or congressional committee of this sort lies in the fact that its opinions are not only based upon expert knowledge, but that they can be to an extent enforced; whereas such a body of men with no official position may go on making suggestions and protesting, as have numerous such bodies for years, without producing any practical results. The matter is, with us perhaps, one of more importance to future generations; but as all Nature seems ordered primarily with reference to the future welfare of the race, rather than for the comfort of its present members, the necessity for such an official body, whose specific business should be to look after the preservation of objects of historical interest to the succeeding centuries, ought to be inculcated in us as a part of the general evolutionary scheme.

Physical Measurements of Asylum Children.—Dr. Ales Hrdlicka has published an account of anthropological investigations and measurements which he has made upon one thousand white and colored children in the New York Juvenile Asylum and one hundred colored children in the Colored Orphan Asylum, for information about the physical state of the children who are admitted and kept in juvenile asylums, and particularly to learn whether there is anything physically abnormal about them. Some abnormality in the social or moral condition of such children being assumed, if they are also physically inferior to other children, they would have to be considered generally handicapped in the struggle for life; but if they do not differ greatly in strength and constitution from the average ordinary children, then their state would be much more hopeful. Among general facts concerning the condition of the children in the Juvenile Asylum, Dr. Hrdlicka learned that when admitted to the institution they are almost always in some way morally and physically inferior to healthy children from good social classes at large—the result, usually, of neglect or improper nutrition or both. Within a month, or even a week, decided changes for the better are observed, and after their admission the individuals of the same sex and age seem gradually, while preserving the fundamental differences of their nature, to show less of their former diversity and grow more alike. In learning, the newcomers are more or less retarded when put into the school, but in a great majority of cases they begin to acquire rapidly, and the child usually reaches the average standing of the class. Inveterate backwardness in learning is rare. Physically, about one seventh of all the inmates of the asylum were without a blemish on their bodies—a proportion which will not seem small to persons well versed in analyses of the kind. The differences in the physical standing of the boys and the girls were not so great or so general as to permit building a hypothesis upon them, though the girls came out a little the better. The colored boys seemed to be physically somewhat inferior to the white ones, but the number of them was not large enough to justify a conclusion. Of the children not found perfect, two hundred presented only a single abnormality, and this usually so small as hardly to justify excluding them from the class of perfect. Regarding as decidedly abnormal only those in whom one half the parts of the body showed defects, the number was eighty-seven. "Should we, for the sake of illustration, express the physical condition of the children by such terms as fine, medium, and bad, the fine and bad would embrace in all 192 individuals, while 808 would remain as medium." All the classes of abnormalities—congenital, pathological, and acquired—seemed more numerous in the boys than in the girls. The colored children showed fewer inborn abnormalities than the white, but more pathological and acquired. No child was found who could be termed a thorough physical degenerate, and the author concludes that the majority of the class of children dealt with are physically fairly average individuals.

Busy Birds.—A close observation of a day's work of busy activity, of a day's work of the chipping sparrow hunting and catching insects to feed its young, is recorded by Clarence M. Weed in a Bulletin of the New Hampshire College Agricultural Experiment Station. Mr.

Weed began his watch before full daylight in the morning, ten minutes before the bird got off from its nest, and continued it till after dark. During the busy day Mr. Weed says, in his summary, the parent birds made almost two hundred visits to the nest, bringing food nearly every time, though some of the trips seem to have been made to furnish grit for the grinding of the food. There was no long interval when they were not at work, the longest period between visits being twenty-seven minutes. Soft-bodied caterpillars were the most abundant elements of the food, but crickets and crane flies were also seen, and doubtless a great variety of insects were taken, but precise determination of the quality of most of the food brought was of course impossible. The observations were undertaken especially to learn the regularity of the feeding habits of the adult birds. The chipping sparrow is one of the most abundant and familiar of our birds. It seeks its nesting site in the vicinity of houses, and spends most of its time searching for insects in grass lands or cultivated fields and gardens. In New England two broods are usually reared each season. That the young keep the parents busy catching insects and related creatures for their food is shown by the minute record which the author publishes in his paper. The bird deserves all the protection and encouragement that can be given it.

Park-making among the Sand Dunes.—For the creation of Golden Gate Park the park-makers of San Francisco had a series of sand hills, "hills on hills, all of sand-dune formation." The city obtained a strip of land lying between the bay and the ocean, yet close enough to the center of population to be cheaply and easily reached from all parts of the town. Work was begun in 1869, and has been prosecuted steadily since, with increasing appropriations, and the results are a credit to the city, Golden Gate Park, Mr. Frank H. Lamb says in his account of it in The Forester, having a charm that distinguishes it from other city parks. It has a present area of 1,040 acres, of which 300 acres have been sufficiently reclaimed to be planted with coniferous trees. "It is this portion of the park which the visitor sees as one of the sights of the Golden Gate." As he rides through the park out toward the Cliff House and Sutro Heights by the Sea, "he sees still great stretches of sand, some loose, some still held in place by the long stems and rhizomes of the sand grass (*Arundo arenaria*). This is the preparatory stage in park-making. The method in brief is as follows: The shifting sand is seeded with *Arundo arenaria*, and this is allowed to grow two years, when the ground is sufficiently held in place to begin the second stage of reclamation, which consists in planting arboreal species, generally the Monterey pine (*Pinus insignis*) and the Monterey cypress (*Cupressus macrocarpus*); with these are also planted the smaller *Leptospermum lævigatum* and *Acacia latifolia*. These species in two or more years complete the reclamation, and then attention is directed to making up all losses of plants and encouraging growth as much as possible." The entire cost of reclamation by these methods is represented not to average more than fifty dollars per acre.

A Fossiliferous Formation below the Cambrian.—Mr. George F. Matthew said, in a communication to the New York Academy of Sciences, that he had been aware for several years of the existence of fauna in the rocks below those containing *Paradoxides* and *Protolenus* in New Brunswick, eastern Canada, but that the remains of the higher types of organisms found in those rocks were so poorly preserved and fragmentary that they gave a very imperfect knowledge of their nature. Only the casts of *Hyolithidæ*, the mold of an obolus, a ribbed shell, and parts of what appeared to be the arms and bodies of crinoids were known, to assure us that there had been living forms in the seas of that early time other than Protozoa and burrowing worms. These objects were found in the upper division of a series of rocks immediately subjacent to the Cambrian strata containing *Protolenus*, etc. As a decided physical break was discovered between the strata containing them and those having *Protolenus*, the underlying series was thought worthy of a distinctive name, and was called Etchemenian, after a tribe of aborigines that once inhabited the region. In most countries the basement of the Paleozoic sediments seems almost de-

void of organic remains. Only unsatisfactory results have followed the search for them in Europe, and America did not seem to promise a much better return. Nevertheless, the indications of a fauna obtained in the maritime provinces of Canada seemed to afford a hope that somewhere "these basement beds of the Paleozoic might yield remains in a better state of preservation. The author, therefore, in the summer of 1898, made a visit to a part of Newfoundland where a clear section of sediments had been found below the horizons of *Paradoxides* and *Agraulos strenuus*. These formations were examined at Manuel's Brook and Smith's Sound. In the beds defined as Etchemenian no trilobites were found, though other classes of animals, such as gastropods, brachiopods, and lamellibranchs, occur, with which trilobites elsewhere are usually associated in the Cambrian and later geological systems. The absence, or possibly the rarity of the trilobites appears to have special significance in view of their prominence among Cambrian fossils. The uniformity of conditions attending the depositions of the Etchemenian terrane throughout the Atlantic coast province of the Cambrian is spoken of as surprising and as pointing to a quiescent period of long continuance, during which the *Hyolithidæ* and *Capulidæ* developed so as to become the dominant types of the animal world, while the brachiopods, the lamellibranchs, and the other gastropods still were puny and insignificant." Mr. Matthew last year examined the red shales at Braintree, Mass., and was informed by Prof. W. O. Crosby that they included many of the types specified as characteristic of the Etchemenian fauna, and that no trilobites had with certainty been obtained from them. The conditions of their deposition closely resemble those of the Etchemenian of Newfoundland.

The Paris Exposition, 1900, and Congresses.—The grounds of the Paris Exposition of 1900 extend from the southwest angle of the Place de la Concorde along both banks of the Seine, nearly a mile and a half, to the Avenue de Suffren, which forms the western boundary of the Champ de Mars. The principal exhibition spaces are the Park of the Art palaces and the Esplanade des Invalides at the east, and the Champ de Mars and the Trocadéro at the west. Many entrances and exits will be provided, but the principal and most imposing one will be erected at the Place de la Concorde, in the form of a triumphal arch. Railways will be provided to bring visitors from the city to the grounds, and another railway will make their entire circuit. The total surface occupied by the exposition grounds is three hundred and thirty-six acres, while that of the exposition of 1889 was two hundred and forty acres. Another area has been secured in the Park of Vincennes for the exhibition of athletic games, sports, etc. The displays will be installed for the most part by groups instead of nations. The International Congress of Prehistoric Anthropology and Archæology will be held in connection with the exposition, August 20th to August 25th. The arrangements for it are under the charge of a committee that includes the masters and leading representatives of the science in France, of which M. le Dr. Verneau, 148 Rue Broca, Paris, is secretary general. A congress of persons interested in aërial navigation will be held in the Observatory of Meudon, the director of which, M. Janssen, is president of the Organizing Committee. Correspondence respecting this congress should be addressed to the secretary general, M. Triboulet, Director de Journal l'Aeronaute, 10 Rue de la Pepinière, Paris.

English Plant Names.—Common English and American names of plants are treated by Britton and Brown, in their Illustrated Flora of the Northern United States, Canada, and the British possessions, as full of interest from their origin, history, and significance. As observed in Britton and Holland's Dictionary, "they are derived from a variety of languages, often carrying us back to the early days of our country's history and to the various peoples who, as conquerors or colonists, have landed on our shores and left an impress on our language. Many of these Old-World words are full of poetical association, speaking to us of the thoughts and feelings of the Old-World people who invented them; others tell of the ancient mythology of our ancestors, of strange old mediæval usages, and of superstitions now almost forgotten."

Most of these names, Britton and Brown continue in the preface to the third volume of their work, suggest their own explanation. "The greater number are either derived from the supposed uses, qualities, or properties of the plants; many refer to their habitat, appearance, or resemblance, real or fancied, to other things; others come from poetical suggestion, affection, or association with saints or persons. Many are very graphic, as the Western name prairie fire (*Castillea coccinea*); many are quaint or humorous, as cling rascal (*Galium sparine*) or wait-a-bit (*Smilax rotundifolia*); and in some the corruptions are amusing, as Aunt Jerichos (New England) for *Angelica*. The words horse, ox, dog, bull, snake, toad, are often used to denote size, coarseness, worthlessness, or aversion. Devil or devil's is used as a prefix for upward of forty of our plants, mostly expressive of dislike or of some traditional resemblance or association. A number of names have been contributed by the Indians, such as chinquapin, wicopy, pipsissewa, wankapin, etc., while the term Indian, evidently a favorite, is applied as a descriptive prefix to upward of eighty different plants." There should be no antagonism in the use of scientific and popular names, since their purposes are quite different. The scientific names are necessary to students for accuracy, "but the vernacular names are a part of the development of the language of each people. Though these names are sometimes indicative of specific characters and hence scientifically valuable, they are for the most part not at all scientific, but utilitarian, emotional, or picturesque. As such they are invaluable not for science, but for the common intelligence and the appreciation and enjoyment of the plant world."

Educated Colored Labor.—In a paper published in connection with the Proceedings of the Trustees of the John F. Slater Fund, Mr. Booker T. Washington describes his efforts, made at the suggestion of the trustees, to bring the work done at the Tuskegee school to the knowledge of the white people of the South, and their success. Mr. Carver, instructor in agriculture, went before the Alabama Legislature and gave an exhibition of his methods and results before the Committee on Agriculture. The displays of butter and other farm products proved so interesting that many members of the Legislature and other citizens inspected the exhibit, and all expressed their gratification. A full description of the work in agriculture was published in the Southern papers: "The result is that the white people are constantly applying to us for persons to take charge of farms, dairies, etc., and in many ways showing that their interest in our work is growing in proportion as they see the value of it." A visit made by the President of the United States gave an opportunity of assembling within the institution five members of the Cabinet with their families, the Governor of Alabama, both branches of the Alabama Legislature, and thousands of white and colored people from all parts of the South. "The occasion was most helpful in bringing together the two sections of our country and the two races. No people in any part of the world could have acted more generously and shown a deeper interest in this school than did the white people of Tuskegee and Macon County during the visit of the President."

Geology of Columbus, Ohio.—In his paper, read at the meeting of the American Association, on the geology of Ohio, Dr. Orton spoke of the construction of glacial drifts as found in central Ohio and the source of the material of the drift, showing that the bowlder clay is largely derived from the comminution of black slake, the remnants of which appear in North Columbus. He spoke also of the bowlders scattered over the surface of the region about Columbus, the parent rocks of which may be traced to the shores of the northern lakes, and of Jasper's conglomerate, picturesque fragments of which may be found throughout central Ohio. Some of these bowlders are known to have come from Lake Ontario. Bowlders of native copper also occur, one of which was found eight feet below the surface in excavations carried on for the foundations of the asylum west of the Scioto.

Civilized and Savage.—Professor Semon, in his book In the Australian Bush, characterizes the treatment of the natives by the settlers as constituting,

on the whole, one of the darkest chapters in the colonization of Australia. "Everywhere and always we find the same process: the whites arrive and settle in the hunting grounds of the blacks, who have frequented them since the remotest time. They raise paddocks, which the blacks are forbidden to enter. They breed cattle, which the blacks are not allowed to approach. Then it happens that these stupid savages do not know how to distinguish between a marsupial and a placental animal, and spear a calf or a cow instead of a kangaroo, and the white man takes revenge for this misdeed by systematically killing all the blacks that come before his gun. This, again, the natives take amiss, and throw a spear into his back when he rides through the bush, or invade his house when he is absent, killing his family and servants. Then arrive the 'native police,' a troop of blacks from another district, headed by a white officer. They know the tricks of their race, and take a special pleasure in hunting down their own countrymen, and they avenge the farmer dead by killing all the blacks in the neighborhood, sometimes also their women and children. This is the almost typical progress of colonization, and even though such things are abolished in the southeastern colonies and in southeast and central Queensland, they are by no means unheard of in the north and west."

MINOR PARAGRAPHS.

In a brood of five nestling sparrowhawks, which he had the opportunity of studying alive and dead, Dr. R. W. Shufeldt remarked that the largest and therefore oldest bird was nearly double the size of the youngest or smallest one, while the three others were graduated down from the largest to the smallest in almost exact proportions. "It was evident, then, that the female had laid the eggs at regular intervals, and very likely three or four days apart, and that incubation commenced immediately after the first egg was deposited. What is more worthy of note, however, is the fact that the sexes of these nestlings alternated, the oldest bird being a male, the next a female, followed by another male, and so on, the last or youngest one of all five being a male. This last had a plumage of pure white down, with the pin feathers of the primaries and secondaries of the wings, as well as the rectrices of the tail, just beginning to open at their extremities. From this stage gradual development of the plumage is exhibited throughout the series, the entire plumage of the males and females being very different and distinctive." If it be true, as is possibly indicated, that the sexes alternate in broods of young sparrowhawks as a regular thing, the author has no explanation for the fact, and has never heard of any being offered.

Architecture and Building gives the following interesting facts regarding the building trades in Chicago: "Reports from Chicago are that labor in building lines is scarce. The scarcity of men is giving the building trades council trouble to meet the requirements of contractors. It is said that half a dozen jobs that are ready to go ahead are at a standstill because men can not be had, particularly iron workers and laborers—the employees first to be employed in the construction of the modern building. It is also said that wages have never been better in the building line. The following is the schedule of wages, based on an eight-hour day: Carpenters, $3.40; electricians, $3.75; bridge and structural iron workers, $3.60; tin and sheet-iron workers, $3.20; plumbers, $4; steam fitters, $3.75; elevator constructors, $3; hoisting engineers, $4; derrick men, $2; gasfitters, $3.75; plasterers, $4; marble cutters, $3.50; gravel roofers, $2.80; boilermakers, $2.40; stone sawyers and rubbers, $3; marble enamel glassworkers' helpers, $2.25; slate and tile roofers, $3.80; marble setters' helpers, $2; steamfitters' helpers, $2; stone cutters, $4; stone carvers, $5; bricklayers, $4; painters, $3; hod carriers and building laborers, $2; plasterers' hod carriers, $2.40; mosaic and encaustic tile layers, $4; helpers, $2.40."

In presenting the fourth part of his memoir on The Tertiary Fauna of Florida (Transactions of the Wagner Free Institute of Science, Philadelphia), Mr. William Healey Dall observes that the

interest aroused in the explorations of Florida by the Wagner Institute and its friends and by the United States Geological Survey has resulted in bringing in a constantly increasing mass of material. The existence of Upper Oligocene beds in western Florida containing hundreds of species, many of which were new, added two populous faunas to the Tertiary series. It having been found that a number of the species belonging to these beds had been described from the Antillean tertiaries, it became necessary, in order to put the work on a sound foundation, besides the review of the species known to occur in the United States, to extend the revision to the tertiaries of the West Indies. It is believed that the results will be beneficial in clearing the way for subsequent students and putting the nomenclature on a more permanent and reliable basis.

The numerical system of the natives of Murray Island, Torres Strait, is described by the Rev. A. E. Hunt, in the Journal of the Anthropological Society, as based on two numbers—*netat*, one, and *neis*, two. The numbers above two are expressed by composition—*neis-netat*, three; *neis i neis*, or two and two, four. Numbers above four are associated with parts of the body, beginning with the little and other fingers of the left hand, and going on to the wrist, elbow, armpit, shoulder, etc., on the left side and going down on the right side, to 21; and the toes give ten numbers more, to 31. Larger numbers are simply "many."

President William Orton, of the American Association, in his address at the welcoming meeting, showed, in the light of the facts recorded in Alfred R. Wallace's book on The Wonderful Century, that the scientific achievements of the present century exceed all those of the past combined. He then turned to the purpose of the American Association to labor for the discovery of new truth, and said: "It is possible that we could make ourselves more interesting to the general public if we occasionally foreswore our loyalty to our name and spent a portion of our time in restating established truths. Our contributions to the advancement of science are often fragmentary and devoid of special interest to the outside world. But every one of them has a place in the great temple of knowledge, and the wise master builders, some of whom appear in every generation, will find them all and use them all at last, and then only will their true value come to light."

NOTES.

The number of broods of seventeen-year and thirteen-year locusts has become embarrassing to those who seek to distinguish them, and the trouble is complicated by the various designations different authors have given them. The usual method is to give the brood a number in a series, written with a Roman numeral. Mr. C. L. Marlatt proposes a regular and uniform nomenclature, giving the first seventeen numbers to the seventeen-year broods, beginning with that of 1893 as number I, and the next thirteen numbers (XVIII to XXX) to the thirteen-year broods, beginning with the brood of 1842 and 1855 as number XVIII.

Experimenting on the adaptability of carbonic acid to the inflation of pneumatic tires, M. d'Arsonval, of Paris, has found that the gas acts upon India rubber, and, swelling its volume out enormously, reduces it to a condition like that following maceration in petroleum. On exposure to the air the carbonic acid passes away and the India rubber returns to its normal condition. Carbonic acid, therefore, does not seem well adapted to use in inflation. Oxygen is likewise not adapted, because it permeates the India rubber and oxidizes it, but nitrogen is quite inert and answers the purpose admirably.

Mr. Gifford Pinchot, Forester of the Department of Agriculture, has announced that a few well-qualified persons will be received in the Division of Forestry as student-assistants. They will be assigned to practical field work, and will be allowed their expenses and three hundred dollars a year. They are expected to possess, when they come, a certain degree of knowledge, which is defined in Mr. Pinchot's announcement, of botany, geology, and other sciences, with good general attainments.

In a communication made to the general meeting of the French Automobile Club, in May, the Baron de Zeylen enumerates 600 manufacturers in France who have produced 5,250 motor-carriages and about 10,000 motor-cycles; 110 makers in England, 80 in Germany, 60 in the United States, 55 in Belgium, 25 in Switzerland, and about 30 in the other

states of Europe. The manufacture outside of France does not appear to be on a large scale, for only three hundred carriages are credited to other countries, and half of these to Belgium. The United States, however, promises to give a good account of itself next time.

Mine No. 8 of the Sunday Creek Coal Company, to which the American Association made its Saturday excursion from Columbus, Ohio, has recently been equipped with electric power, which is obtained by utilizing the waste gas from the oil wells in the vicinity. This, the Ohio State Journal says, is the first mine in the State to make use of this natural power.

In a bulletin relating to a "dilution cream separator" which is now marketed among farmers, the Purdue University Agricultural Experiment Station refers to the results of experiments made several years ago as showing that an increased loss of fat occurs in skim milk when dilution is practiced, that the loss is greater with cold than with warm water, and that the value of the skim milk for feeding is impaired when it is diluted. Similar results have been obtained at other experiment stations. The results claimed to be realized with the separators can be obtained by diluting the milk in a comparatively inexpensive round can.

To our death list of men known in science we have to add the names of John Cordreaux, an English ornithologist, who was eminent as a student, for thirty-six years, of bird migrations, and was secretary of the British Association's committee on that subject, at Great Cotes House, Lincolnshire, England, August 1st, in his sixty-ninth year; he was author of a book on the Birds of the Humber District, and of numerous contributions to The Zoölogist and The Ibis; Gaston Tissandier, founder, and editor for more than twenty years, of the French scientific journal *La Nature*, at Paris, August 30th, in his fifty-seventh year; besides his devotion to his journal, he was greatly interested in aërial navigation, to which he devoted much time and means in experiments, and was a versatile author of popular books touching various departments of science; Judge Charles P. Daly, of New York, who, as president for thirty-six years of the American Geographical Society, contributed very largely to the encouragement and progress of geographical study in the United States, September 19th, in his eighty-fourth year; he was an honorary member of the Royal Geographical Society of London, of the Berlin Geographical Society, and of the Imperial Geographical Society of Russia; he was a judge of the Court of Common Pleas of New York from 1844 to 1858, and after that chief justice of the same court continuously for twenty-seven years, and was besides, a publicist of high reputation, whose opinion and advice were sought by men charged with responsibility concerning them on many important State and national questions; Henri Lévêgne de Vilmorin, first vice-president of the Paris School of Horticulture; O. G. Jones, Physics Master of the City of London School, from an accident on the Dent Blanche, Alps, August 30th; Ambrose A. P. Stewart, formerly instructor in chemistry in the Lawrence Scientific School, and afterward Professor of Chemistry in the Pennsylvania State College and in the University of Illinois, at Lincoln, Neb., September 13th; Dr. Charles Fayette Taylor, founder of the New York Orthopedic Dispensary, and author of articles in the Popular Science Monthly on Bodily Conditions as related to Mental States (vol. xv), Gofio, Food, and Physique (vol. xxxi), and Climate and Health (vol. xlvii), and of books relating to his special vocation, died in Los Angeles, Cal., January 25th, in his seventy-second year.

Efforts are making for the formation of a Soppitt Memorial Library of Mycological Literature, to be presented to the Yorkshire (England) Naturalists' Union as a memorial of the services rendered to mycological science and to Yorkshire natural history generally, by the late Mr. H. T. Soppitt.

The United States Department of Agriculture has published, for general information and in order to develop a wider interest in the subject, the History and Present Status of Instruction in Cooking in the Public Schools of New York City, by Mrs. Louise E. Hogan, to which an introduction is furnished by A. C. True, Ph. D.

The United States Weather Bureau publishes a paper On Lightning and Electricity in the Air, by Alexander G. McAdie, representing the present knowledge on the subject, and, as supplementary to it or forming a second part, Loss of Life and Property by Electricity, by Alfred J. Henry.

A gift of one thousand dollars has been made to the research fund of the American Association for the Advancement of Science by Mr. Emerson McMillin, of New York.

FREDERICK C. SELOUS.

APPLETONS' POPULAR SCIENCE MONTHLY.

DECEMBER, 1899.

EXACT METHODS IN SOCIOLOGY.

By FRANKLIN H. GIDDINGS, Ph. D.,
PROFESSOR OF SOCIOLOGY IN COLUMBIA UNIVERSITY.

THOSE who do pioneer work in science encounter not only the inherent difficulties of research and interpretation, but also the misapprehension of certain educated men whose distinctive gift is a fatal genius for applying false standards of measurement to the progress of thought. Seizing upon some branch of knowledge that is in a state of vigorous development, when its newer results are out of harmony with its earlier hypotheses, such critics love to point out these contradictions, and try to prove that the branch in question is no science at all, and that its teachers are hardly worthy of respectful consideration.

The history of science contains many interesting chapters pertaining to this kind of criticism and the fate that has invariably overtaken it. When Copernicus and Galileo showed the absurdity of the Ptolemaic astronomy, the theologians enjoyed themselves for a time, as they demonstrated—to their own entire satisfaction—the folly of all rationalistic attempts to explain what revelation only could make clear. When Darwin explained the origin of species through variation and natural selection, the pretensions of biology were completely exploded by its lay and clerical critics (they thought and said so) by the extremely simple device of the "deadly parallel column." Was not Cuvier a great anatomist, and had he ever taught this nonsense about the mutability of species? Was not Agassiz the most learned naturalist alive, and what had he to say about Darwinian vagaries? Had he not proved, over and over again, that the very concept of the species was the

notion of a group of characteristics that could not possibly change or be changed from generation to generation? In more recent years we have again seen the same method of reducing science to a variety show for the entertainment of the tired general reader applied to both biology and psychology. Weismann has tried to prove that acquired characteristics are not transmitted in heredity, and that the germ plasm is distinct from the somatic cells. The neo-Lamarckians, Spencer, Cope, and some of the botanists have contended for the older interpretation. Is biology, then, a science? Forbid the thought! Heaven preserve our minds from such confusion!

If the sociologists have hoped that they alone might not be overtaken by easy annihilation, they deserve to be humiliated. But it is safe to say that they have cherished no such illusions. If the men who have devoted much time to the scientific explanation of society have had no other qualification for their task, they have at least shown some acquaintance with the history of thought. And so it is not likely that they have suffered deeply from disenchantment when they have been confronted with the regulation exposure of "the present position" of their science.

There is no need of wasting space to prove that the kind of criticism here referred to is without scientific value. The present position of any science can not be determined by arraying its contradictions and inconsistencies, irrespective of a serious attempt to ascertain which of its concepts and hypotheses have inherent vitality. It is precisely when a science is at its best, surely advancing year by year and full of promise for the future, that contradictions most abound in its monographs and text-books.

A true scientific criticism, then, must proceed by a different method. The present position of a science can be ascertained only by instituting three specific inquiries, namely: First, among the more or less contradictory conceptions and hypotheses which constitute its groundwork, what ones are surely displacing all others and gaining the wider acceptance among active students? Second, what progress is being made in the application of exact methods to research? Third, is there a practical or working harmony between the concepts that are gaining ground and the more exact methods of research that are being perfected? Do the concepts and hypotheses lend themselves to exact methods, and do they, on the whole, help to perfect methods? Do improving methods, on the whole, confirm or strengthen the concepts that are gaining wider acceptance?

If these inquiries are applied in the domain of sociology they bring to light unmistakable evidence of a steady and gratifying

progress toward scientific consistency and rigor of method. Much babble about social ills and possible reforms still masquerades as social science. A great deal of loose thinking and slipshod investigation is paraded as expert opinion on questions of social welfare. But no one who has seriously followed the efforts of scientifically trained minds to discover the natural laws of social evolution is in any danger of confounding the results thus far obtained with the chatter over every passing fad. In the more serious work itself there is found a vigorous and hopeful disagreement of opinion upon all unsettled questions. But the fact of real significance is that the disputation has become intensive. The debate no longer ranges over a wide field. A selective process has eliminated one after another the more loose and vague conceptions of the science, the irrelevant issues, and the superficial analogies. There has been a progressive concentration of attention upon a group of closely related and fundamental problems.

The sociology of August Comte was little more than a highly intelligent and quickening talk about social order and progress. It convinced thoughtful men that there is a social order to be studied in a scientific spirit and by scientific methods, and that social progress conforms to laws that may be discovered. Mr. Spencer narrowed the field of sociological inquiry and gave precision of statement to all social problems by bringing them within the formulas of universal evolution. He still further narrowed the field by demonstrating the close relationship of social phenomena to the phenomena of organic evolution and by seizing upon certain psychological facts as chief factors in social causation. All fruitful later work in social interpretation has been a further concentration of investigation upon the psychic factors. While admitting that social as well as mental phenomena are subsumed under biological phenomena, and that the parallelism of social organization to biotic organization is real, the younger students of sociology have developed the science as an offshoot of psychology, and have dropped the biological analogy as unfruitful for purposes of research. The pioneer in this movement was Dr. Lester F. Ward, whose masterly analysis of the psychic factors of social phenomena gave the right direction for all time to sociological inquiry, and whose emphasis of the importance of reason and volition in the social process, although it has not yet received the attention that it merits, is destined to be fruitful in coming years.

To the further study of the psychological foundations of society practically all the valuable work on fundamental social problems has been given during the past ten years. Tarde has

given us profound studies of imitation and invention; Gumplowicz and Le Bon, of the psychology of races and culture groups; Novicow, of the psychology of conflict and toleration; Le Bon and Durkheim, of the psychology of crowds, of co-operation, and of the division of labor; Baldwin, of the psychology of the social unit—the *socius*.

Thus it appears that while sharp disagreements of opinion still exist relative to the priority or the generality of one or another of these psychic factors in the social process, discussion has focused about the psychological phenomena themselves. There has been a progressive limitation of the field and an increasing definiteness of conception and hypothesis.

My own effort, if now I may be pardoned for referring to it, has been to restrict the field yet further, and to make the problems of sociology yet more specific. I have contended that these psychological phenomena which have been seized upon for purposes of sociological interpretation are still too vaguely conceived. They are often disclosed to the inquirer in purely individual as well as in social aspects. The lines of inquiry between the study of mind in general, of mind as individual, and of mind as manifesting itself socially in the concert or co-operation of a number of individual minds, have not been drawn with sufficient precision. I have tried to show that the psychological phenomena that Ward, Tarde, Gumplowicz, Novicow, Le Bon, Durkheim, Baldwin, and others have so admirably analyzed as psychic factors of society are social when, and only when, they have certain coefficients, namely: (1) The coefficient of resemblance—that is, a fundamental similarity of individuals to one another underlying and, on the whole, dominating their innumerable differences; (2) the coefficient of awareness or consciousness of resemblance—that is to say, certain feelings, perceptions, or thoughts of resemblance, which give rise to varied prejudices and preferences that facilitate or prevent effective co-operation. Whether this contention of mine will prevail, whether there will ultimately be a general agreement among sociologists that these coefficients of resemblance and consciousness of kind are the true *differentia* of social phenomena, time and further research must determine.

The second inquiry through which we may learn somewhat of the present position of sociology relates to the development of method. Exact method in social research is statistical. Wherever we can obtain numerical data within the domain of social phenomena, there we arrive at exact or quantitative knowledge. The development and application of statistical methods to social problems has been one of the most striking scientific achievements

of the present century. When Quételet, in 1835, published his great work, *Sur l'Homme et le Développement de ses Facultés*, he laid the foundation for a thorough statistical investigation of psychological and sociological no less than of anatomical phenomena. And after the publication, in 1846, of his work, *Sur la Théorie des Probabilités appliquées aux Sciences morales et politiques*, followed, in 1848, by *Du Système social et des Lois qui le régissent*, there was a rapid development of statistical methods in precision, and of attempts to extend the statistical method to groups of facts which had until then been studied only from a purely qualitative or, at best, a vaguely comparative point of view. At the present time every subdivision of descriptive sociology draws data from rich collections of statistical materials, and employs statistical methods for the further extension of knowledge.

Thus, in the study of the social population, statistical methods are employed not only to give the total number of inhabitants dwelling within a given territory and the degree of density of population per square mile, but also to show to what extent population increases by births in excess of deaths, to what extent by immigration in excess of emigration, and to what extent the composition of the population is rendered complex by the intermingling of many nationalities. The character of a population, also, and its social capacities are in a large measure statistically investigated. General intelligence is studied by means of statistics of literacy and illiteracy; industrial preferences by statistics of occupation; habits of industry by statistics of the number in every thousand of the total population who regularly follow gainful occupations; frugality by statistics of savings, insurance, and home ownership; and the amount of communication, whereby assimilation and coöperation are rendered possible, by statistics of travel, mail, and telegraphic service.

Passing to that study of concerted feeling, thought, and purpose which may be called a study of the social mind, and which constitutes the second great division of descriptive sociology, we find that it can be carried on, and that to a great extent it is prosecuted, by means of statistical research. We have statistics incomplete, but admitting of perfection, of those impulsive, emotional disturbances of masses of men which take the form of strikes, insurrections, lynchings, and revivals. The report of the United States Department of Labor on strikes, published in 1894, and a recently published monograph by Dr. Frederick S. Hall on Sympathetic Strikes, show the possibilities of this method whenever it shall be exhaustively applied. It could be successfully applied to the other phenomena mentioned. By painstaking effort and a sufficient ex-

penditure of money the data could be obtained. Lombroso and Laschi, in their work, *Le Crime politique et les Révolutions*, have made a beginning toward the collection of statistics of insurrections and revolutions. More exact, at present, are our statistics of the rational working of the minds of large numbers of men in communication and co-operation. These we have in the familiar form of election returns, which show us the decisions that communities make on questions of public policy and administration. This information could be increased by the application of statistical analyses to the vast body of statute law and judicial decisions. A beginning of such work has been made in the valuable Bulletin of State Legislation, published by the New York State Library.

In the third division of descriptive sociology—that, namely, which treats of social organization—the application of statistical method is proceeding with great rapidity. We have not only statistics (yearly improving in quality) of marriage and divorce, of the organization of all governmental departments, military and civil, of chartered corporations, of religious and educational societies, but also of the thousands of associations formed for the promotion of special interests, recreation, scientific research, art and literature, and philanthropy. Every year the statistical information on these matters, included in such compilations as The World Almanac, becomes not only more extensive but more precise.

Yet more abundant are the statistical accumulations pertaining to that fourth and last division of descriptive sociology which treats of the social welfare—of the functioning of society, of the ends for which it exists. We have statistics of prosperity, of the accumulation and distribution of wealth, of the expansion and contraction of credit, and of business failures. We have statistics of longevity. We ascertain improving sanitary conditions by changes in the death rate. We learn by statistical methods of the increase or decrease of accident and death due to public disorder or maladministration. We ascertain through educational statistics the decrease of illiteracy and superstition. And by the same means we ascertain the dimensions of pauperism and of crime. Not only so, but, by a certain refinement of statistical method, applied by competent men like Sir Francis Galton, we ascertain the increase or decrease and the distribution of the higher manifestations of intellectual ability and moral character.

Thus the whole field of descriptive sociology is being more and more exhaustively studied by statistical methods that are yearly improving in precision. So far, then, as may be judged from the development of its methods, no science at the present time is making surer and better progress than sociology, and none is offering

to the general public conclusions based upon more exact methods of induction.

Let us now look at the relations which the development of statistical method bears to that development of fundamental conceptions, which has already been described. Do we here discover increasing harmony, a tendency toward co-ordination, or have analyses of concepts, on the one hand, and developments of statistical method, on the other hand, followed diverging lines?

There can be no possible doubt of the answer that must be made to these questions. Conceptions and methods are in as perfect accord as can be discovered in any branch of science. The merest glance over the field of social statistics shows that, for the most part, they record and classify phenomena that are essentially psychological. In working from the general theory of evolution through the biological parallelism down to psychological premises, analytical sociology has been doing in one way precisely what statistics have been doing in another. The moment we pass from statistics of density and distribution of population we find ourselves dealing next with groups of facts that are biological (the facts, namely, of distribution according to sex and age periods), through facts that are partly biological and partly psychological in character (the facts, namely, of nationality), and then, leaving these behind, we deal henceforth entirely with facts that belong to the mental and moral categories. To name them would be only to repeat the categories already enumerated: the statistics of intelligence, industry, and moral character, of emotional or rational social action, of various forms of organization for the achievement of as many different purposes, and of the development of the conscious personality of man as a result of his social relations and activities.

Not only is this true, but the further interesting fact may be discovered that social statistics of every category employed or known are based upon a frank recognition of that coefficient of resemblance, physical or mental, which I have contended is a mark of social phenomena. The first step in statistical tabulation is classification, and classification invariably starts from an assumption of real or supposed resemblance. Not to dwell on such fundamental distinctions as those of color, race, and nationality, we encounter the more special resemblances of agreement in religious belief, agreement in industrial preference, agreement in political conviction (as shown in election returns), similar susceptibility to emotionalism, similar capacities for rational comprehension, similar imperfections of nature, which result in lives of crime or pau-

perism. Remove from social statistics this postulate that blood kinship or mental resemblance between one social unit and another is the basis of social phenomena, and the statistics themselves would cease to exist.

Statistics reveal also the consciousness which men have of their resemblances and their differences. It is statistically known that the geographical distribution of nationalities is not accidental or capricious. Immigrant Italians, Germans, and Scandinavians find their way to those parts of the country where men of their own blood and speech are already established. Intermarriages of men and women of different nationalities are statistically known to be frequent where no differences of religion exist, and infrequent where different nationalities profess different faiths. The statistics of political elections are quite as much statistics of the consciousness of kind as of differences of mental type itself.

The most significant fact of all, however, has still to be named. It is this: From the first known beginnings of statistical research to the present time every extension of statistical inquiry has been in a large measure due to the consciousness of kind. The first statistical surveys of communities of which we have any record were such tribal enumerations as those recorded in the book of Numbers, the avowed object of which was to ascertain the strength and resources of the various tribes by clans, lesser gentile groups, and households, not more for utilitarian reasons than for the gratification of gentile and tribal pride. The census taken in Greece in 594 B. C. was for the purpose of dividing the people into four classes and levying taxes according to wealth. The constitution of Servius Tullius, 550 B. C., distinguished six property classes, and the attempt to determine these statistically was one of the earliest experiments in census-making at Rome. The Domesday Book of William I (1086) is the first great statistical document in English history, and its origin was due to a desire to know not only the military and fiscal strength of the nation, but also its class distinctions and feudal relationships. The great stimulus given to statistical investigation by the French Revolution was an obvious product of class feeling. Most of the refinements of statistical inquiry in later years have had a like origin. Such, for example, was the cause of the discrimination in our own census of the foreign born from the native born, and of the native born of foreign parents from both native and foreign born. Such has been the cause of the attempt to get more exact statistics of religious denominations, of labor organizations, and of the distribution of wealth. Had there been no reason for including these costly inquiries in statistical investigations, except that of their general

utility and scientific interest, the appropriation for them would have been denied in Congress without an instant's hesitation. They have been included because of the political deference given to class feeling and to various forms of religious and educational prejudice.

Thus there is seen to be a remarkable interdependence of statistical method and psychological analysis in the development of sociological research. Analysis and method have converged upon the same postulates, and it is apparently by the development of methods frankly founded upon these postulates that our sociological knowledge is to be further increased.

It would be a great mistake, however, to assume that sociological knowledge is to be increased only by the further collection and interpretation of numerical data. Careful monographic description and historical research must continue to be important sources of both information and hypothesis. The great defects of monographic work, both descriptive and historical, are, first, a certain lack of precision, attributable to the large part played in investigation by the individual judgment of the student (the lack of objective tests by which his subjective impressions may be critically examined); second, a certain incompleteness, attributable to a failure to separate each inquiry into all its scientific subdivisions and to attempt to obtain desired data under each subdivision, as is done in statistical investigation where, in every table, as many topics as there are scientific subdivisions of the general subject are represented by columns, and an entry of some kind is made in every column.

I wish now to point out the possibility of giving greater precision to monographic work in sociology by the introduction of quasi-statistical methods—methods that are essentially quantitative in an algebraic sense, though they are not numerical.

Social phenomena have the interesting characteristic that small forces, while never lost in that composition of forces which determines the ultimate equilibrium of the social system, often count for absolutely nothing in the practical affairs of a given generation. If, for example, Mr. Bryan and a Democratic Congress had been elected in 1896, the practical consequences for the United States would have been much the same whether the Democratic plurality had been one hundred thousand, half a million, or two or three millions. This is but one example of a large class of facts. Social phenomena are more often than not determined by a mere matter of more or less, rather than by the exact amount or degree of more or less. The determination is algebraic rather than arithmetical. Is the element under investigation a positive

or a negative quantity? Is its sign plus or minus? That is usually the important question for the sociological student.

Now it happens that a great many investigations in descriptive sociology do not as yet admit of the introduction of exact statistical—that is, arithmetical—inquiries which, nevertheless, do admit the use of algebraically quantitative methods. In the monographic description of a community many questions arise which can not be answered by the entry of figures in a column, but which could be answered by entering in a column a symbol indicating that a certain trait, habit, or choice could be predicated of a large majority, or of a small majority, or of only a large minority, or of only a small minority of the entire population. That is to say, it often happens that an observer who can not take a perfect census (getting answers to all his questions from every individual in the community), and who therefore can not fill out his columns with arithmetical values, can, by such interviewing as is possible to him and by such an examination of the objective products of social activity as are open to the inspection of any one who chooses to observe them critically, determine with absolute certainty whether certain things are true of majorities or only of minorities.

Suppose, for example, that a traveler is studying an out-of-the-way settlement, or a tribe, which presents many points of interest that are comparatively novel. All who are familiar with the narratives of travel and exploration which Mr. Spencer has used as data for his Descriptive Sociology are aware that they are almost totally devoid of system. The reader is told that such marriage customs, such clan relationships, such political institutions, such industrial operations, have been observed. The all-important coefficient is left out. What the student of sociology would most of all like to know is how many individuals in the community manifest such or such a trait; how many have such or such a habit; how many profess such or such a belief; how many adhere to this organization, how many to that. But since this exact arithmetical knowledge usually can not be obtained within the limited time and under the circumstances of a traveler's researches, he should try to get at least partially quantitative results by noting in every instance whether the phenomenon observed is true of a majority or only of a minority of the people under investigation.

This simple method admits of a high degree of refinement by the obvious device of subdividing the total human mass under observation into enumeration units. If, for example, we are studying the social character and activities of the people of the United States, we may take the fifty Commonwealths and Territories as enumeration units. Making out a tabular form, we may enter

in the left-hand column the names of the several States and Territories. At the top of successive columns, counting from left to right, we may enter words designating the social phenomena to be observed. Then, taking the States and Territories in order, we may enter opposite the name of each a symbol indicating that a majority large or small, or a minority large or small, of the inhabitants of the State or Territory in question manifests the trait or follows the activity, or belongs to the social organization designated at the top of the column. The symbols that I have found most convenient in use are these: For a large majority, a double plus sign thus, ⧺; for a small majority, a single plus sign thus, +; for a large minority, a double plus sign in a circle thus, ⊖; for a small minority, a single plus sign in a circle thus, ⊕.

The great possibilities in this method of giving precision to observations and records of the facts of social psychology and activity become daily more obvious to students who practice it with reasonable care. Almost any desired degree of accuracy can be attained by taking smaller and smaller enumeration units. Thus, if I wish to form and to record my judgment as to whether the people of the United States as a whole manifest a high, a medium, or a low degree of general intelligence, I seem to be raising a question that admits of little better answer than a statement of vague impressions. But let me take a concrete measure of high general intelligence—for example, the general intelligence of a town noted for its large proportion of scientific and professional men, its graded schools, its satisfactory school attendance, and its low percentage of illiteracy. Let me then subdivide the United States into fifty parts—namely, the Commonwealths and Territories—and let me enter in a column opposite the name of each a symbol indicating that, as compared with the general intelligence of the town which I have taken as a standard, a large majority or a small majority, or a large minority or only a small minority, of the people in that Commonwealth are of the high general intelligence; that a large majority or a small majority, or a large minority or only a small minority, are of medium intelligence; and that a large majority or a small majority, or a large minority or a small minority, are of low intelligence. Obviously, when I have completed this process I have subjected my vague general impression that the people of the United States as a whole are of high, medium, or low general intelligence to a certain correction and measure. I count up the entries in my columns. I discover that I have made, let us say, nine entries indicating that a large majority of the people in each of nine States are of high intelligence. I find that I have made, let us say, eighteen entries indicating that in each of eight-

een States a small majority of the people are of low general intelligence; and this mere counting of the entries may show me that, when taking the States one by one, I have made a somewhat different estimate of the general intelligence of the people of the entire country from that which I made when looking at all the people of the country as an undivided mass.

If still unsatisfied with my judgment, I may proceed to subdivide each State into its counties, and take the counties as enumeration units. I may go through the process of recording my judgments by entering symbols in the several columns of my table, and at the end I may again count up my totals of high, medium, and low intelligence. Obviously, I can do this work only if I am able to travel through every county in the United States, and, by interviews with people, by forming general impressions and by visiting schools, get a fairly definite idea of the relative intelligence of each civil division; or if, being unable to make this personal inquiry, I resort to printed information—namely, educational reports, miscellaneous public documents, historical records, newspapers, and other objective data throwing light upon the intellectual status of these various divisions. This, I find, is an enormous labor; but if I conscientiously perform it I correct my subjective impressions, and there is a fair presumption that my final result is a judgment vastly nearer the truth than was my first general impression of the intelligence of the whole undivided mass of the American population.

Thus the conscientious use of the method which I have suggested insures, in the interest of precision, two important modifications of ordinary sociological description: First, it subjects the purely subjective processes of judgment to a certain correction and measurement; secondly, it leads the observer step by step, and almost unconsciously, to resort more and more to definite objective data in place of first impressions.

Essentially the same method, by slight modifications of detail, may be extended to historical inquiries. How often do we encounter in historical monographs the statement that, since a certain date, there has been a marked increase of this or that activity, or that such a trait or such a habit, occasionally observed half a century ago, is now characteristic of whole sections or populations! To the credit of the historians, it must be said that careful men seldom make such statements without offering in substantiation of them a certain amount of objective evidence. But the method is loose, and it has the radical defect of permitting such terms as "increase" and "decrease," "great increase" and "great decrease" to stand for different quantities when applied to differ-

ent phenomena under examination in the same treatise. There is no uniformity of measurement. Now, it is easy to introduce uniformity, even where arithmetical values are not known. It is possible to know that we are applying the same method of measurement when we say that, since 1850, there has been a "great" multiplication of lynchings in the United States that we apply when we say that there has been a "great" increase of population, although, in the case of the lynchings, we have not arithmetical values, while in the case of the increase of population we have.

This can be done in the following way: Distinguish and designate degrees of increase or decrease by symbols thus: No change, $= 0$; absolute increase but relative decrease, $= +1$; absolute increase with no relative decrease, $= +2$; great absolute increase without relative decrease, $= +3$; absolute and relative increase, $= +4$; absolute decrease but relative increase, $= -1$; absolute decrease without relative increase, $= -2$; great absolute decrease without relative increase, $= -3$; absolute and relative decrease, $= -4$.

Now let the historian who wishes to pass in review the quantitative changes that have occurred since a given time—for example, 1850—before he puts on paper his impressions, based upon such evidence as he has been able to collate, put down all these symbols against the name of each of the social phenomena which he is studying. He will instantly see that he is trying to apply to each of the phenomena whose changes he wishes to record a certain scale of measurement, and he at once asks himself: What do I really mean by such a term as "relative" increase or decrease when contrasted with "absolute" increase or decrease; and what do I mean by such a term as "great" increase or decrease when contrasted with such a term as "increase" or "decrease" without a modifying word? The moment he puts these questions before his mind he will feel a sinking of heart as he reviews the pages in which he has confidently told his readers that such "absolute" and "relative" changes have from time to time occurred, and reflects that he has seldom been consistent in his use of these terms.

How, then, shall he attain consistency and precision? To be consistent and precise in the use of the word "relative" it is necessary to make at the outset an arbitrary choice of a term of comparison, just as in making comparative judgments of such a phenomenon as general intelligence it is necessary to take as a standard the phenomenon as observed in a particular community. The most suitable term of comparison for all judgments of increase or decrease in social phenomena is the increase or decrease of population per square mile within the area and during the period stud-

ied. The increase of population is arithmetically measured, and it stands in relations of direct causation to every social change. The historian, therefore, in forming his judgments of relative increase or decrease should always take the increase or decrease of population per square mile as his term of comparison.

What meaning, finally, shall be attached to the word "great" when the historian wishes to distinguish "great" increase or "great" decrease from "increase" or "decrease" in general, and absolute statistics are not available? There is one, and, as far as I can see, only one, perfectly satisfactory procedure.

Let the investigator subdivide the community which he is studying into enumeration units according to the method suggested above for the descriptive monograph. Let him then make as many tables as there are ten-year periods in the general historical period that he is investigating. That is to say, let him make a table for 1850, for 1860, for 1870, for 1880, and for 1890. Let him then proceed according to the method laid down for the descriptive monograph, entering opposite each Commonwealth the symbol for majority or minority, thus showing by States, for each of the ten-year periods, the prevalence of the trait or activity under investigation. Suppose, for example, that the phenomenon studied is the growth of popular interest in prize fighting since 1850. The historian should begin by asking, In what States, if any, in 1850 were large majorities of the people interested in prize fights to the extent of countenancing them and eagerly following their progress? In what States were only small majorities so interested, in what States only large minorities, and in what ones only small minorities? The best answers that the historian can make to these questions, after examining all the evidence that he can command, he should record by entering the proper symbol against each State, after which he should repeat the procedure for the date 1860, for the date 1870, and so on. When his tables are thus completed, he should count up the number of entries of each symbol in each table. If then he finds that in less than half of his enumeration units—i. e., in less than half of all the States and Territories—small minorities have become large minorities, large minorities have become small majorities, or small majorities have become large, he will be justified in concluding that there has been an increase, but not a "great" increase, in popular interest in prize fighting. If, however, he discovers that these changes have occurred in more than half of his enumeration units, he can say with reason that the increase of interest in prize fighting has been "great."

Cases may arise in which a correction of the judgment thus

formed may be necessary. It might be erroneous to say that there had been no great increase of interest in prize fighting if it were discovered that the increase had occurred in two or three Commonwealths only, but that in them it had been phenomenal. The method itself, however, reveals the necessity for correction in such cases and measures the error; for, obviously, a phenomenal increase or decrease in any one enumeration unit would be disclosed by a dropping of the intermediate symbols between ⊕ and ⧺. That is to say, small minorities would become majorities, or great majorities would become small minorities, within an interval during which lesser changes were occurring elsewhere.

Thus, by taking a little trouble, the historian can apply one constant measure to his judgments of increase and decrease, as he reviews social changes. He must subdivide his community into enumeration units, and against each unit, at each convenient date, he must enter a record of his judgment that the trait, activity, interest, or relation under investigation can be predicated of a large or of only a small majority, of a large or of only a small minority, of the individuals composing the enumeration unit. He must then count up the changes from minority to greater minority or to majority, or from majority to minority. Conscientiously following this method, the historian may often make comparisons of great precision, when otherwise his comparisons, made without reference to a common measure, would be little more than suppositions.

Following such methods as these, the writers of descriptive and historical monographs can increase our approximately exact sociological knowledge. Constructing and filling out such tables as have been described, they can bring to light serious gaps in our numerical statistics, and they can thereby suggest and stimulate new statistical inquiries. Thus co-operating, the descriptive writers, the historians, and the statisticians can in time perfect our descriptive sociology, and, co-operating with those students who are completing the analysis of fundamental concepts, they can gradually give precision to our formulations of sociological law.

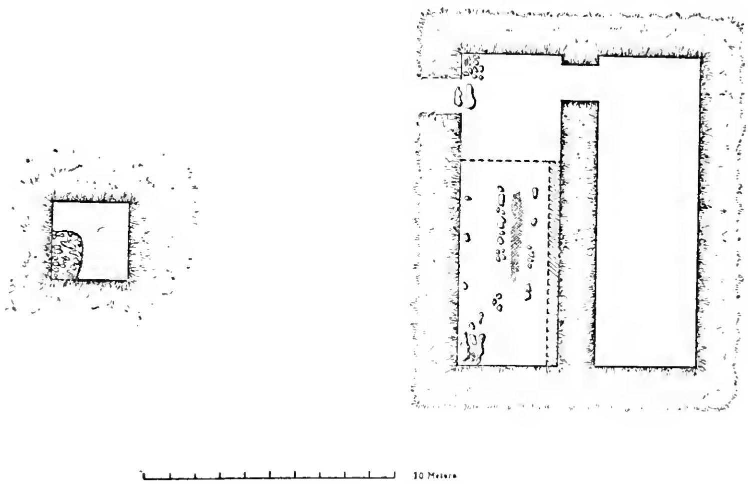
Bishop Creighton, of London, has characterized the present English idea of education as embodying the supposition that "all the child had to do was to sit still like a pitcher under a pump while an expert hand poured in the proper amount of material for it to hold." His own view was that the only education anybody really obtained was that which he gave himself. "The idea prevailing at the beginning of the century was that men should read a good book, master its contents, and pursue for themselves the lines of thought it suggested, and talk it over and make its ideas the subject of discussion among themselves. No system could surely be better."

VINLAND AND ITS RUINS.

SOME OF THE EVIDENCES THAT NORTHMEN WERE IN MASSACHUSETTS IN PRE-COLUMBIAN DAYS.*

By CORNELIA HORSFORD.

THE evidences that Northmen were in Massachusetts in pre-Columbian days are drawn from two sources, geography and archæology. The archæological evidence is found by comparing certain ruins in Massachusetts with ruins of the Saga-time in Iceland, and also with the native and early European ruins on the coast of North America. The geographical evidence is found by



Plan of the House of Eric the Red in Iceland.

comparing the descriptions of the country called Vinland in Icelandic literature with the coast of North America.

The geographical data for this paper are taken from each and all of the three oldest manuscript versions of the story of Vinland, because they complement each other where the descriptions vary in detail. These are called the Flat Island Book, Eric the Red's Saga, and Thorfinn Karlsefni's Saga.

If the coast of North America should repeat the same geographical features, it would obviously be impossible to determine the site of Vinland by geography alone. Let us see if this is so. It is stated in Eric the Red's Saga that Karlsefni's party, which

* A paper read before the Viking Club of London on December 16, 1898; also before the Section of Anthropology of the American Association for the Advancement of Science at the Boston meeting, August, 1898.

consisted of one hundred and sixty men and their live stock in three vessels, after sailing southwest from Greenland for a number of days and seeing two new countries, came to a certain cape. "They cruised along the land and the land lay on the starboard. . . . There were there an open, harborless coast and long strands and

AN INDIAN FIREPLACE IN MASSACHUSETTS.

sand banks. And they went in boats to the land and found there the keel of a ship, and they named it Keel Cape. And they gave a name to the strands and called them Wonder Strands, because they were long to sail by. Then the land became scored with bays, and they steered the ships to the bays." * They remained here for some time, but they had not yet seen the Vinland which Leif Erikson had found a few years before.

Thorhall started to seek for it "northward round Wonderstrand and westward off Keel Cape." Therefore we must first look for a cape, the trend of whose shore is north and south, with open water west of it, and beyond that again land. This cape must have a long, sandy, harborless coast, with sand banks on the east, and it must be broken up into bays farther to the south, and one of these bays must be large enough and deep enough for three vessels, one of which could carry at least fifty men across the Atlantic. The icelandic word "örœfi" which is used in this text means "harborless," and is the descriptive local name of the convex, sandy, unsheltered coast of southern Iceland (Orœfa), the present Skaptafells district, from Stokksnes to Dyrhólaey. This gives a clear idea of what we ought to look for along the coast of North America.

The eastern coast of North America † shows us that, south of rock-bound Labrador, the only places north of New York where

* The translations are from the Icelandic texts in The Finding of Wineland the Good by Arthur Middleton Reeves. Henry Frowde, London.

† Chart of North Atlantic, No. 98. Norie & Wilson, London.

capes are to be found jutting northward from the land are northern Newfoundland, Cape Breton Island, the southern shores of the Gulf of St. Lawrence, Cape Ann, and Cape Cod.

There is no stretch of open, harborless, sandy coast from Cape Bauld to Cape Spear, with its steep, sterile, rocky shores.* There are two or three stretches of unbroken coast from three

Icelandic Fireplace in supposed Norse Ruin in Massachusetts.

to five miles long, north and south of Canada Bay, northwest of Conception Bay, and northeast of Bonavista Bay, but these are not the shores of capes jutting to the north, with long strands and sand banks.

If we begin with Cape Breton and follow the coast northward we find no extensive stretch of harborless coast until we reach Island Point. From this point to Cape Smoke there is a comparatively unbroken coast about thirty miles in extent whose "headlands are composed of primary and metamorphic rocks, principally granite, with clay slate in nearly vertical strata, while sandstone, conglomerate, shale, limestone, and occasionally beds of gypsum and red and yellow marl occur on the intervening shores." † Here, then, there are not long strands and sand banks. Cape North is a headland of slate one thousand feet high.‡ Dr. Gustav Storm, of the University of Christiania, in his well-known book, *Studier over Vinlandsreiserne, etc.*, page 42, points out a resemblance between Cape Breton and Keel Cape, and states that the eastern shores of Cape Breton Island are "specially described as low-lying and sandy." According to the United States Hydrographic Office Report, No. 99, page 289, the southeast coast of Cape Breton Island from Michaux Point to Cape Gabarus "is low and has a barren and rocky appearance, and the shore is broken into numerous lakes and ponds, protected from the sea by beaches of gravel and some small rocky islands and ledges. . . . From Cape Gabarus to Cape Breton, a distance of fifteen miles, the land is of moderate height and the shore broken into coves and small harbors." Between Louisburg and Cape Breton, eight miles be-

* Belle Isle to Boston, No. 102. Norie & Wilson, London.

† United States Hydrographic Office Report, No. 99, 1897, p. 315. ‡ Ibid., p. 314.

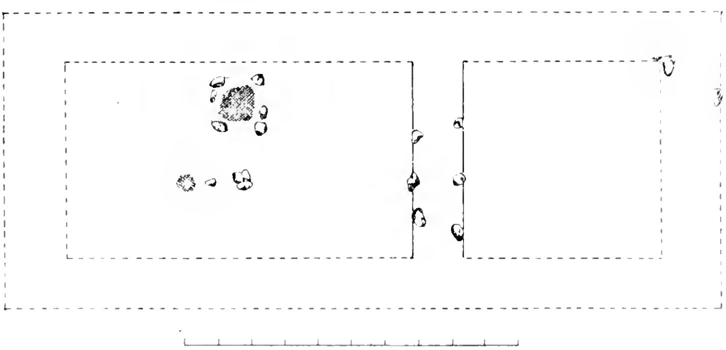
yond, "there are three small harbors, too intricate and rocky in their entrances to admit vessels of any burden," and Cape Breton itself is "low and rocky and covered with grassy moors." This is unlike the open, harborless coast with long strands and sand banks of the Sagas. Within the Gulf of St. Lawrence the capes which jut to the north are Cape St. George,* with rocky, precipitous cliffs six hundred feet above the sea; North Point,† on Prince Edward Island, which is broken about five miles down the coast by Tignish River, and beyond that by the red sandstone cliff of Cape Kildare; Escuminiac Point,‡ at the entrance to Miramichi Bay, a broken coast with low sandstone cliffs; and Birch Point,# on Miscou Island, with a steep cliff of sandstone ten feet high.

Campobello is a rocky island, and Cape Ann is rocky and has no long, harborless coast.

Cape Cod ‖ juts to the north with open water west of it, and beyond that again land. It has also a long, harborless coast on the east, with strands and sand banks, and is scored with bays toward the south.

Cape Cod, then, is the only cape north of Sandy Hook which corresponds to the description in the Saga, and near here we should look for Vinland, leaving the southern shores until later.

Vinland, which was discovered by Leif Erikson, is only described as *Vinland* in the Flat Island Book. This account states



PLAN OF SUPPOSED NORSE RUIN IN MASSACHUSETTS.

that Leif Erikson's party "came to a certain island which lay north of the land." That Leif Erikson should have thought that Cape Cod was an island is obvious, because it is impossible from the cape to see the southern shore of Massachusetts Bay twenty miles away.

* United States Hydrographic Office Report, No. 100, 1897, p. 70.

† Ibid., pp. 130, 152. ‡ Ibid., p. 157. # Ibid., p. 173.

‖ United States Coast and Geodetic Survey, General Chart of the Coast, No. VII.

There is no need to explain why he also believed it to lie north of the land, as no one and final answer can be given, although several can be easily suggested; that water and land again lay to the west is clearly stated in all three accounts.

Afterward "they sailed into that sound which lay between the island and the promontory which jutted northward from the land; they steered in westward past the promontory. There was much

East Wall of a supposed Norse Ruin in Massachusetts, showing Layers of Turf between the Stones.

shallow water at ebb tide, and then their ship stood up and then it was far to look to the sea from their ship." Across the water which lies between Cape Cod and the mainland is Rocky Point, a high and therefore noticeable promontory jutting northward from the land. Past this one can only continue westering to the north, and thence we must now look along the land to find the place where, in the words of the Flat Island Book, "a certain river flowed out of a certain lake," having, as was said before,

great shallows at its mouth at ebb tide, whence it was far to look to the ocean.

Following round the inner coast of Cape Cod, we pass Plymouth and on to Boston before we find in the Charles River and Boston Back Bay a river flowing through a lake into the sea, where great shallows at its mouth are a conspicuous feature and it is far to look to the ocean.

West Wall of a supposed Norse Ruin in Massachusetts, showing Layers of Turf between the Stones.

At this point we may add one more feature to the description of Keel Cape—that it appears to be an island when approached from the north. Now we can continue our search down the North Atlantic coast, noting that Sandy Hook is not scored with bays at the south, and that Cape Henlopen and Cape Henry could not have been mistaken for islands.*

* Chart of North Atlantic, No. 98. Norie & Wilson, London.

There is one event described in all three versions of the Vinland story—the battle with the natives. According to the Flat Island Book, this battle took place in Vinland; according to the other two Sagas, Vinland was supposed to be north of Keel Cape. But in these Sagas it is said that this battle took place *south* of Keel Cape, where Karsefni had found a river flowing through a lake into the sea.

It was this word south which led the Danish archæologist Carl Christian Rafn to think that Vinland was in Rhode Island. Although there is no land south of Cape Cod (with the exception of Nantucket Island) between Cape Cod and Santo Domingo, it is only fair to look once more at Mount Hope Bay * (Rafn's Vinland) to see whether it really corresponds to the description before us. The Taunton River flows through Mount Hope Bay to the sea, but there are no shallows here, and the mouth of the river looks directly out, southward and not eastward, to the open ocean. In Boston Harbor, moreover, are great tongues of land and islands such as are described in Eric the Red's Saga. There is perhaps cause for comment in the use of the word "fjöll," fells or mountains (according to Vigfusson †), applied to the hills about Boston, of which the highest, "Blue Hill," is seven hundred and ten feet high. If "fells" is a correct translation, it would be unobjectionable.

One morning Karlsefni saw the natives in their skin boats rowing toward his house, from the south, past a promontory. It is not difficult to find the only promontory past which canoes could have come from the south between the mouth of the river and Watertown, the head of navigation. Here, then, Leif Erikson and Thorfinn Karlsefni should have built their houses, if this history be true, because this place corresponds with the description of Vinland, and also because we can find no other place on the coast like it.

Having found what appears to be the site of Thorfinn Karlsefni's houses, it is well to inquire next what the characteristic features of the Norse houses of the Saga-time were, and what traces one might hope to find after nearly nine hundred years.

Icelandic homesteads of that period usually consisted of a main house, composed of three or four apartments and one or two outhouses, built on the surface of the ground.

The walls were one and a half metres thick, and from one to one and a half metres high, built of alternate layers of turf and stones on the inside and on the outside, the space between being

* United States Coast and Geodetic Survey Chart, No. 13. Cuttyhunk to Block Island.

† Icelandic-English Dictionary. R. Cleasby. Enlarged and completed by Gudbrand Vigfusson.

filled in with earth. Often, however, the walls were built entirely of turf and earth, or with only disconnected rows of stones at the base. Wood also was sometimes used. It is stated in Thorfinn Karlsefni's Saga that some of the trees in Vinland were "so large they were laid in a house."

A long, narrow fireplace usually extended through the middle of the principal room, and an essential feature was the cooking fireplace, which was about one metre square. These were either paved or surrounded by upright stones. The plan is of the ruin of the house of Eric the Red in Haukadalr, Iceland. It shows the different forms of fireplace, and that the walls, which were built of

Ancient Wall in Iceland, showing Layers of Turf between the Stones.

turf, were one and a half metres thick. Outhouses were often dug into the hillside, and were sometimes walled up on the inside with stone and turf. Ruins of such old settlements in Iceland are usually low, grass-grown ridges and hollows.

When Professor Horsford first visited the site which his study of maps and literature had led him to believe was Vinland, he found a few hollows in the hillside and also some broad, low ridges on the level ground, indicating that a building about twenty metres long by five metres broad had once stood there. There was also a mound some distance away which has since proved to be of modern construction.

No digging was done here until after Professor Horsford's death, with the exception of a few trenches across the supposed site of Leif Erikson's house on the other side of the creek. In 1896, during a visit of Dr. Valtyr Gudmundsson and Mr. Thorsteinn Erlingsson, of Copenhagen and Iceland, extensive excavations were made, leaving practically nothing unexamined at this site.

Three kinds of earth were revealed. The upper layer was of black loam from thirty to forty centimetres deep; below this was a yellow soil of sand and clay thirty centimetres deep; and below that again the sand and gravel which had remained undisturbed since the close of the Glacial epoch.

The ruins were at the junction of the black and yellow earth. Throughout the black loam to the bottom, wherever we dug, within or away from the ruins, were scattered fragments of china, glass, glazed pottery, nails, pipestems, broken bricks, etc., all belonging to the period of the occupation of this region by the English. None of these were found in places where their presence would show that they belonged to or preceded these ruins. In the paved pathway, which will be described later, a few pieces of brick lie between the stones, but not deeper than similar fragments of brick were found in the undisturbed earth near by, apparently trodden in by the cattle which have been pastured there for years. There were also objects of aboriginal manufacture, such as stone implements, pottery, pieces of flint, etc. Occasionally, at different levels, remains of fires were found, some of which were merely thin layers of charcoal and ashes. There were, however, two well-built fireplaces, in good condition, entirely unlike each other. One of these was an Indian clambake, neatly paved and piled with ashes and unopened clam shells. This lay sixty-three centimetres below the sod. The photograph is not of this fireplace, but is a good example of all Indian fireplaces or clambakes in Massachusetts.

Old Wall in a Cellar in Fort William Henry, Maine.

The second fireplace, which was about one metre square, sur-

rounded by upright stones at the four corners and filled with oak charcoal, but no ashes, was the distinctive feature of this ruin, and resembled the cooking fireplaces of the Icelanders. The absence of ashes has been accounted for by absorption in the soft clay soil. Ashes often disappear in this way, but can be detected with acids.

Old Wall at Fort William Henry, Maine.

Although the outline of the walls of the long house can only be suggested, the few stones which were found at the base of the old walls were placed about a metre and a half apart, as in the walls of the Saga-time. This, so far as is known, is peculiar to that period and race. Iroquois long houses were constructed for communal use, and were usually from one hundred to three hundred feet long. The chief traces left are fire rows and kitchen middens. They are not known to have used stone foundations, nor to have made any attempt at regularity of outline. The drawing shows the method of construction of these long houses, which were built only by the Indians of the Iroquois tribe.

Depressions which appeared to be the sites of old huts were in the hillside back of the terrace on which the long house stood, but the roadway in front had apparently destroyed all but one of these, and had also carried away the front wall of this.

This hut was four metres across the front, and may have been five metres deep. When the sod, stones, and the clearings, which had been thrown in from the cultivated field above, were all removed, the remains of two side walls were found, supported and protected by the upper portions of these same walls which had slipped down from above and lay close to them, forming a compact mass of earth and stones. None of the stones in this wall were in contact with each other, being separated by two or three inches of dark earth such as results from the decay of vegetable matter. There was no fireplace. The manner of constructing these walls was the counterpart of Icelandic work. I shall now show you how this differs from post-Columbian cellars.

This is a photograph of a ruin in the Thjór's River Valley, in Iceland. It shows the sod between the stones closely packed but

distinct. The stones in our early English and French cellars practically touch each other, as in the old cellar in Fort William Henry, in Maine. Sometimes broken stones fill the interstices, as in another example of stonework at Fort William Henry. Mortar has been used here more or less since the beginning of the seventeenth century.

Although European or post-Columbian walls and cellars differ considerably among themselves, it is within certain limits. Post-

Supposed Norse Pathway in Massachusetts.

Columbian walls, or foundation walls when built on the surface of the ground, were practically homogeneous in character, the French only attaining to one metre in thickness, whereas Icelandic walls were disposed in three distinct parts, the inner and outer sides being constructed in layers and the space between being filled in with closely packed earth, while they were never less than a metre and a half thick.

Southern Turn of supposed Norse Pathway.

Icelandic outhouses when dug into a hillside dispensed with the triple wall at the back and on the sides, and thus when stone-faced partially resemble our cellars. But even then they still retain one characteristic feature, in their alternate layers of turf and stone.

A Pavement at Fort William Henry, Maine.

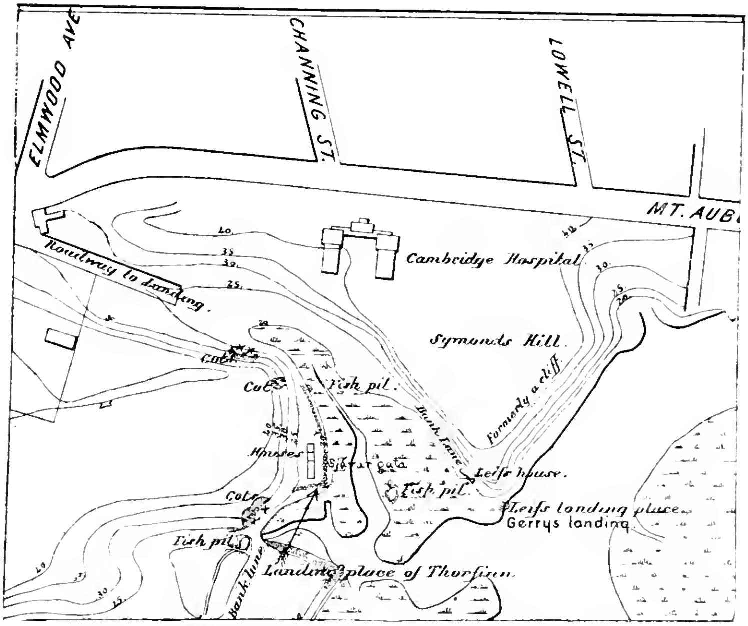
While this hut was being dug out, our attention was called to stones protruding through the turf a short distance away and nearer to the water. When the earth was cleared away, it proved to be a rude stone-laid pathway leading along the margin of the old creek to the river. Here at the landing place a similar pathway branched away in another direction, stopping suddenly a few metres south of the supposed house of Thorfinn Karlsefni. This pathway is called in Iceland a *sjávar-gata*, or path to the sea. Ancient pavings have been found at Fort William Henry, near Pemaquid, Maine. They are, however, similar to many street pavements still to be found in our eastern cities. There is also a remarkable paved gutter at the Lewis Farm, in Maine, which has long interested historians. But none of these resemble the *sjávar-gata* in its peculiar construction, especially where it broadens and divides with a wide margin of pebbles on one side and small heaps of stones on the other.

A Pavement at Pemaquid, Maine.

This map was made for Professor Horsford about ten years ago. It shows the site of the long house, in which the Icelandic fireplace was found, and the cot, in which Icelandic walls were found. The paved path ran along the shore

in front. Professor Horsford fixed Thorfinn's landing place a short distance south of this, on solid ground. Geologists are unable to say how long ago the salt marshes were formed. They are on Winthrop's map of 1634, but the *sjávar-gata* could hardly have been accessible as a landing place after their formation.

In summary, it may be said that at the only point of land on the coast of North America which we have found to correspond with the description of the site of Thorfinn Karlsefni's houses, ruins have been dug out which bear peculiar features characteristic of the period in Iceland known as the Saga-time, and differ-



MAP OF THE SUPPOSED NORSE RUIN IN CAMBRIDGE, MASSACHUSETTS.

ing in certain essential features from the handiwork of all the native races of North America, and, as far as is known at present, from all other races in Europe or in America in post-Columbian days.

Extracts from the Reports of Dr. Gudmundsson and Mr. Erlingsson.

The following extracts, from reports by Dr. Gudmundsson and Mr. Erlingsson, refer to the ruins described in the preceding paper. The plan for these researches was first to compare the aforesaid ruins with the work of the native races supposed to have inhabited or vsited these shores, next with that of the Norsemen of the eleventh century, and later, if necessary, with the earliest English, French, Spanish, and Dutch ruins on these shores. Dr. Gudmundsson and Mr. Erlingsson noted the

points of resemblance between these and Icelandic ruins, and in their reports by request wrote everything they could think of in opposition to, as well as in favor of, their being of Norse origin.

When these gentlemen left Cambridge the characteristic features of the early post-Columbian ruins on this coast had not been ascertained, and these researches were not finished satisfactorily until a year and a half after the Icelanders returned to Europe.

From Dr. Gudmundsson's Report.

The next place into which we dug was a depression or hollow in the hillside in a northerly direction from the above-mentioned place. Here we found unquestionable remains of a house which had been dug into the hillside, with walls constructed of stones, and layers of earth between the single rows of stones. The foundation and the lower parts of the two side walls were solid and well preserved, but the whole back wall, with the exception of a single row (the foundation), had fallen down. The stones from this and the upper parts of the side walls covered the whole bottom, so that they at the first glance seemed to form a pavement. When carefully examined, it was evident, however, that most of the stones which covered the bottom belonged to the walls, though some might have rolled down from the hill above the house. Thus it could clearly be seen how some of the stones had fallen down from the walls and some were just sliding down, without having as yet reached to the bottom, as some stones underneath had hindered them from gliding farther. The front wall of the house was wanting, and must either have been of wood or—which seems most likely—have been spoiled when the road which runs close past the house was made. When the bottom was cleared of the stones which had fallen in it proved to consist of a level black floor.

The construction and situation of this house are *quite* Scandinavian, built in the same way as houses in Iceland and Greenland. I would therefore not have had the least hesitation to declare it to be a ruin of a house built by Scandinavians in the pre-Columbian period if between and under the stones which covered the bottom we had not found some pieces of glazed pottery and bricks, of which some small pieces were found trodden down even into the floor itself. This seems to indicate that the house must be post-Columbian, or at least have been occupied by the first English or French colonists. As in the meantime several American scholars, with whom I have had an opportunity to discuss this matter, positively declare that the post-Columbian colonists never would have built such walls of stones without mortar, and it must be regarded as *quite* certain that Indian people could not have built it, there seems to be no other explanation possible than that this ruin must be Scandinavian, and, having been found by some of the first post-Columbian colonists (e. g., some fishermen), had been repaired and occupied by them for a shorter or longer time. If it can be proved that such a building as this could not have been built by the post-Columbian colonists nor by Indians, it can hardly be anything else than Scandinavian. This, however, must be left to American scholars, who have sufficient knowledge in these matters. But so long as this is not proved, the pieces of pottery and bricks which were found in it rather seem to speak for its post-Columbian origin, as those pieces must have been there when the house fell down, and

such a house as this built in the beginning of the eleventh century could not have stood five hundred years before its roof and the upper parts of the walls fell down.

On the other side of the road we found an end of an old path paved with small stones, running from the house in the hillside along the edge of the old river bank down to a kind of promontory which in olden time, when the water stood much higher than it now does, seems to have served as a landing place. In the middle of this path, which was from about six to ten inches under the surface, was a hollow as trodden down by the feet of men and (perhaps) horses. This path is very like Icelandic paths, such as may still be found in many places in Iceland. But as we in some places in this path found some bricks between the stones which formed its pavement, it must be regarded as doubtful whether it is Scandinavian. The bricks seem rather to speak for a post-Columbian origin, though the whole path is so primitive that it hardly can be suggested that so advanced a people as the first post-Columbian colonists should have made such a path. To settle the question whether it could belong to those colonists must be left to American scholars. This path seems, at any rate, to have been made by the same people who built the house in the hillside, so either both of them must be regarded as post-Columbian or they both are Scandinavian. Another path runs from this landing place in a westerly direction along the old river bank, where it stops very abruptly on a certain spot a very short distance east of the supposed "Thorfinn's house." As I could not find any other reason for its stopping on this spot than that near it stood a building, I examined the river bank beside it, and here I found the earth, about eight inches under the surface, mixed with charcoal, which could indicate that some refuse from a house had been thrown there. This seems to lead to the conclusion that there at the end of this path really has stood a building, of which we could not now expect to find any traces, or even a building constructed of turf only (turf walls), which also might have wholly disappeared, as earth walls on an elevated ground like this perhaps might have blown away.

The result of these researches is briefly, according to my opinion, this: As far as concerns the construction, both the house in the hillside and the two paths, or the two branches of the path, could be of Scandinavian origin, but I am not so well acquainted with the life and customs of the first post-Columbian colonists as to be able to decide whether they could not have been made by them. This, therefore, must be left to American scholars. Very respectfully yours,

VALTYR GUDMUNDSSON.

CAMBRIDGE, MASS., *July 16, 1896.*

From Mr. Erlingsson's Report.

It is not uncommon in Iceland that houses, especially small outhouses, are dug into small hills, hillsides, or sloping ground, just as this house is. It is, in fact, built very like what I have seen in outhouses in many places in Iceland, and what is left of the walls here nobody could distinguish from Icelandic walls. The size and the whole form is also very like an outhouse, but as most frequently in outhouses either all the four walls are made of stones or none of them, it would seem strange that one of the walls here is completely wanting. But those stones which

were used in it could have been used in the road which has been made past the house, or, besides, it is possible that the front wall of the house has been a wooden one, and, although this is very rare in outhouses certainly, yet it must be taken into consideration that here it is much easier to procure wood than in Iceland. The whole form, the method, and the condition of the house itself seemed like nothing else than that it was built by Icelandic hands, although some of the stones seem to be rather small, but, as pieces of pottery and bricks have been found beneath the stones which had fallen down from the walls and on the floor itself, it seems to prove sufficiently that the house can not belong to the old Icelandic period; but as nobody has expected such a house here, the discovery is very remarkable.

This path is so like paths in Iceland, for which there have been gathered stones and which later on have been trodden down by the feet of horses and men, that I would not have hesitated to declare that it might be Scandinavian if in it there had not been found bricks beside the other stones, which seems to indicate that the path must belong to the same period as the house which was dug into the hill. This discovery must therefore, too, be regarded as very remarkable. . . .

Respectfully,

THORSTEINN ERLINGSSON.

CAMBRIDGE, MASS., *July 12, 1896.*

THE EDUCATION OF THE NEMINIST.

By DAVID STARR JORDAN,
PRESIDENT OF LELAND STANFORD JUNIOR UNIVERSITY.

THE meeting of the Astral Club of Alcalde, on September 10, 1899, was rendered memorable by the return, from a month's absence in the East, of the secretary of the club, Miss Corintha Jones, D. N. N. N. Her presence had been sorely missed at the August meeting (though I say it who should not), for it is not often that one of our devoted band is absent from his post.

Miss Jones had left Alcalde to complete a course of study in medicine in one of the most famous colleges of the East. At the suggestion of the president of the club, Mr. Asa Marvin, F. T. S., the usual programme was suspended on her return, and Miss Doctress Jones, D. N. N. N. (for such indeed is the title she has now earned), told us of her studies at the Massachusetts University of Mentiphysics, in Boston, a noble institution, up to date in all respects, for it received its charter from the General Assembly of Massachusetts in the year 1881.

Miss Doctress Jones left her home in Alcalde on the 20th of July, designing to visit certain relatives residing at Homer and Virgil, Cortland County, N. Y., on the way. She reached Boston on the 5th day of August, and at once proceeded to the university.

An ignorant hackman took her over to the suburban village of Cambridge, which is the seat of Harvard College. Making inquiry of the professors there, she found none who had ever heard of the University of Mentiphysics, having eyes and ears for nothing but Harvard, which in some respects is indeed a great institution, but on a material plane.

At last, after much inquiry, Doctress Jones was sent to the Neministic Headquarters, a small building on the corner of Milk and Transcendental Streets. Here she learned, from a little lady with a withered face and a serene smile, that the University of Mentiphysics was situated not in Boston, but in the neighboring town of Lynn, which lies some miles to the north. "But in Massachusetts," she said, "we call it all Boston."

"So I took the train for Lynn," Miss Doctress Jones continued, "and drove at once to the street and number named on the card. The little white house with green blinds, white columns on the veranda, and a few weedy roses in the front yard did not fill my conception of a university, for it did not look like our universities in California. But the fault was with my conception, not with the fact.

"The maid who answered the bell assured me that this was indeed the university, and ushered me at once into the office of the president. The wall was covered with pictures and photographs, showing elderly ladies with serene smiling faces. Under each one were the letters N. N. N., and a card giving an account of how each one had been made whole and happy through Neministic Science. The president was a middle-aged, matronly lady, with a high forehead and brown hair, streaked with gray, done in graceful frizzes over her brow. Above the corners of her mouth, which were always drawn up in an engaging smile, were three deep creases. Mr. Gridley, our schoolmaster, tells me that these correspond to the grave accent in Greek, and that there being three of them shows that the lady had been married three times. I do not know as to this, but somehow her face seemed startlingly familiar and at the same time strangely pleasant.

"I murmured something about having had the pleasure before. She said, taking the words from my mouth: 'I know what you are going to say. We are indeed very much alike, though she is on the material plane. Still, my friends call me the "Lydia Pinkham of the soul," and I do not resent it, for what dear Lydia tries to do, that I do.'

"I told the president," Doctress Jones continued, "that I wished to learn the wisdom of Boston, and especially the science of Neministic Healing, of which I had heard much in Alcalde. 'But per-

haps I should call at the university, and not trouble you in your rest at home.' At this her eyes blazed, and she said, with a tragic air: 'Having eyes, ye see not! I read the Soul and the Stars through a higher than mortal sense. Has the Sun forgotten to shine and the Planets to revolve around it? Who was it discovered, demonstrated, and teaches the marvel of Neministic Healing? That one, whoever it be, does understand something of what can not be lost.'

"I looked dazed. She quieted down and explained to me that she was herself the university, because no one but herself could explain what was revealed to her alone. The whole Neministic Science was taught in twelve lessons, and I could begin then and there.

"I said something about preparatory work and the books I would need to read. She placed in my hands a slip which read:

"'N. N. N. Persons contemplating a course in the Massachusetts University of Mentiphysics can prepare for it through no books save Neministic Science and Astral Health, with a Key to the Stars. Man-made theories are narrow, else extravagant, and always materialistic. *Nihil nemini nocet.*' Then she added: 'I recommend students not to read so-called scientific works antagonistic to Neministic Healing, which advocate material systems, because such works and words becloud the right sense of Mentiphysical Science. A primary student richly imbued with the Neministic spirit is a better healer and teacher than a normal-class student, who partakes less of this power. Even an apt scholar who has dipped into my Neministic Science and Astral Health, with a Key to the Stars (the last revised edition), may enter this field of labor, without any personal instruction, beneficially to himself and the race.'

"Then she continued blandly: 'You must learn, my dear, to enter this great field in a manner beneficial to yourself and the race. You must teach others to render to Cæsar what is Cæsar's, and to do this you must first render unto Cæsar yourself. Do you understand?' I looked puzzled for a moment. Then she said: 'Twenty-five dollars, please, dear, and be sure to come promptly at ten o'clock to-morrow. You are now admitted to the Primary Plane, the first degree of Neministic Healing.' As I gave her the California gold, she bowed me out of the room with a tender and motherly smile, while she tested the unfamiliar coins by ringing them softly on the table.

"At the second lesson she gave me the fundamental principles of Neministic Healing. I received them eagerly, for I recognized in them a close harmony with the teachings of our dear old Mr. Dean:

"'God is the principle of Mentiphysics. As there is but one God, there can be but one Principle in this Science. As there are many stars, there must be many fixed rules for the demonstration of this Divine Principle.

"'The fundamental propositions among these rules are proved by inversion, for this is the basis of all true mathematics. Two times two is four, therefore four is two times two. As a star is the same whether seen from the north, south, east, or west, so a precept of Mentiphysics must be the same as seen from every side. To invert is not to change its meaning, and must prove its truth.' Then she gave me a printed card containing these words, over which I was to ponder until the next lesson:

"'N. N. N. There is no Pain in Truth, therefore there is no Truth in Pain. There is no Nerve in Mind, therefore there is no Mind in Nerve. There is no Matter in Mind, therefore there is no Mind in Matter. There is no Matter in Life, therefore there is no Life in Matter. There is no Matter in Good, therefore there is no Good in Matter. *Nihil nocet nemini; nihil nemini nocet.*'

"'Twenty-five dollars, please,' and I returned to my hotel filled with new thoughts, which I found later were very incomplete.

"The next day she said:

"'Man, my dear, is governed by Soul, not sense. Sense is the reflection of matter, and matter does not exist. Thus sense is but the shadow of a dream. In dreams the laws of health are valueless. There is but one Law of Health, and that is the one precept of Neministic Healing.

"'To the awakened mind the seasons will come and go, with changes of time and tide, cold and heat, latitude and longitude. The agriculturist finds that these changes can not affect his crops. The mariner will have dominion over the atmosphere and the great deep, over the fish of the sea and the fowls of the air. The astronomer will no longer look up to the stars. He will look out from them upon the universe, and the florist will find his flower before he beholds its seed. Thus matter will be finally proved to be nothing but a mortal belief, wholly inadequate to affect man through its supposed organic action or existence.'

"Then she gave me another mystic card, which read:

"'N. N. N. We tread on forces. Withdraw them, and Creation must collapse. *Nihil nocet nemini.*' And this time I did not need to be reminded of the final ceremony with which the lesson ended. Nor did she need to clink the coins on the table.

"In the fourth lesson the president discoursed more fully on 'the popular gods, Sin, Sorrow, and Sickness, the three S's of Satan; all three illusions of the Sinful Soul. The very word Illu-

sion proves their nothingness. These are but troubled dreams of the darkened soul, and to rise above them is to wake from a cataleptic nightmare to see the stars shining on the hills.

"'When troubled by a horrible dream, my dear, one has only to say, "This is a Dream; I will awaken." Then the stars will shine through the open window and the hideous vision will disappear.

"'So in afflictions of disease and dread and death, one must say, "This is a Dream." Then it becomes a dream, and we rise above it into an atmosphere of Perfect Serenity.

"'To the material sense, dear,' continued the president, 'to cut the jugular vein takes away life. But in Neministic Science Life goes on unchanged, mounting ever and ever to higher reaches, because there is no jugular vein, and Matter can not make its mark on Mind.

"'The Barometer, that little prophet of storm and sunshine, can not be deceived by testimony of the senses. It points to fair weather in the midst of the unreal apparition of murky clouds and threatening rain. Thus does Neministic Science, the perfect culmination of Mentiphysics, point to the changeless Health and Happiness of the Enlightened Man whatever material science may have to say about the condition of his members. Man is made in the image of perfection, therefore failure and imperfection can never assail him. As well expect to gather peaches from a pine tree as to gather discord from the Concord of Being.'

"Then she gave me a card:

"'N. N. N. The Equipollence of the Stars above and of the Mind below shows the awful unreality of Evil. *Nihil nemini nocet.*'

"After the usual parting ceremony I returned to my room, well convinced of the unreality of Boston, and doubting whether I should ever again find my own Alcalde. I feared lest some further precept might arise by which Alcalde could not exist.

"In the fifth lesson the president informed me that I was now in the second degree, or Normal Plane. We were ready for the first glimpse into the full, rounded perfection of Neministic Healing.

"'To cure men of all ills whatsoever, we have only to show them the stars. When we waken in the night, only the sight of the stars can tell us we are awake. When we are awake all dreams must vanish, and all is dream which breaks the serenity of the mind or checks the perfect perspicacity of being. We need not deal with the body, for the body does not exist. It is dull, heavy, and aching, because it is the dead Residuum of Dream. When we forget it, it is no longer there. Then and not till then can you

smile the serene smile of the Neministically Healed and Mentiphysically Perfect Soul.'

"The little card read:

"'N. N. N. The body says, "I am ill." The reports of Sickness may form a coalition with the reports of Sin and say, "I am Malice, Lust, Appetite, Envy, Hate." Treat a belief in sickness as you would sin—with sudden dismissal. If it were not for what the human mind says of the body, the body would not be weary any more than an inanimate wheel. *Nihil nemini nocet.*'

"On the sixth day the president greeted me with her serenest smile.

"'We have now reached the point, my dear,' she said, 'when we must abandon Pharmaceutics and take up Ontology, the science of Abstract Being. In this we have many rivals who echo the cry, "Why art thou, NEMINISM, come hither to torment us before our time?" Among the systems that thus cry out are many whom this world deems successful. Animal Magnetism, Atheism, Spiritualism, Theosophy, Agnosticism, Pantheism, and Infidelity are antagonistic to Mentiphysics and fatal to the demonstration thereof, and of Neminism, its noblest culmination; and so,' she continued, 'are some other systems.'

"She warned me especially against Pantheism, 'the worship of the sylvan god Pan,' a cult reputed to be especially rife among the members of our club at Alcalde.

"I tried to explain to her the difference between Pantheism and Sciosophy, but I did not succeed very well, for she grew impatient. In her judgment, I discovered, Sciosophy was grossly impractical, and the views of Mr. Abner Dean would take the bread from the mouths of better men than he. 'I am told,' she said, 'that Mr. Dean actually signed that wicked paper * of those Wash-

* In this document it is asserted that Neministic Science and Astral Health with a Key to the Stars "and all of the inspired writings shall be free—i. e., free from the love of the lust of gain and that the charging of three dollars for Science and Health, etc., when it can be printed and sold for less than fifty cents per copy, is wrong in principle, and, in effect, shuts the doors of this beautiful truth upon the poor by thus putting a prohibitive price upon it. . . .

"We hold that in the giving of class instruction the teacher is entitled to a reasonable compensation, and give our opinion that such compensation should be ten dollars, and we do condemn the present practice when they charge one hundred dollars for a series of twelve lessons. Take a class of thirty—which is not unusual—the teacher receives about $258 per day for two hours' work. This is unjust, and especially so, because many of these teachers are unable and unfit for teaching.

"In the matter of healing, when the healer gives the proper time to the work, one dollar per treatment ought not to be excessive, but the practice of some of charging before the patient is received into the room and then heavily charged for the treatment, is an outrage, . . . and should be prohibited."—*See full text, Washington News Letter, September 6, 1899; Editor.*

ington soreheads, who call themselves the Reformed College of Neminism.' With this, she would not listen to another word about Sciosophy.

"Then I regretted that I had said anything, for this pleasant lesson came to an abrupt end, and left me without even the customary card to ponder over. I still wondered what could be the secret meaning of N. N. N., *nihil nemini nocet.*

"On the next day the storm had blown over, or rather, like all other storms, it had no real existence, and the smile of the president at the closing act of the lesson was the sweetest I had ever seen, the most perfect witness to the truth of her teachings.

"She took up the subject of Materia Medica. After reading from a printed book the names of a host of poisons, from Abacus to Swamproot and Sandalwood and *Zygadene*, she warned us against them all. All are alike evil. All alike have no real existence. Therefore the student will do well not to learn their names. It will only interfere with his serenity of mind, and perfect serenity is the sole symptom of success.

"'Surely this is better,' she said, 'than to support the popular systems of medicine, when the physician may be perchance an infidel and lose ninety-and-nine patients where Neminism cures its hundred. Is it because Osteopathy and Ostariopathy are more fashionable and less spiritual? Even business men have found that Neministic Science enhances their physical and mental powers, enlarges their perception of character, gives them acuteness and comprehensiveness, and an ability to exceed their ordinary business capacity.'

"Then she gave me this card:

"'N. N. N. In 1866 this discovery was made by me and by me alone: "The erring Mortal misnamed Mind produces all the organism and action of the mortal body." This led to the demonstration that Mind is All and matter is naught, and being nothing, nothing hurts nobody. Nobody hurts nothing, which proves it plainly by inversion. *Nihil nocet nemini; nihil nemini nocet.*'

"On the eighth day the president discoursed on Anatomy. Referring briefly to the pernicious notions of the 'ancients,' as with a broad sweep of her hand she designated the professors in Boston and Cambridge, concerning the structure of the human body, she called it the nightmare of undigested learning. 'Why should we care where the jugular vein goes, when we know that there is no jugular vein? What of bones and muscles, and teguments and integuments? "Toil fatigues me," you say; but what is this me? Is it muscle or Mind? Which is tired, and so speaks? Without

Mind could the muscles be tired? Do the muscles talk, or do you talk for them? Science includes no rule of discord, but governs harmoniously.'

"On the card were these words:

"'N. N. N. Flesh is an error of physical belief; a supposition that life, substance, and intelligence are in matter; an illusion; a belief that matter has sensations. *Nihil nocet nemini.*'

"On the ninth day I was admitted to the third degree, or the Introspective Plane. As the president entered, I noticed a touch of camellia powder on her face, for the subject of the day was Beauty. 'Beauty,' she said, 'is internal before it is perceived outwardly. To have perfect faith in the principle of Neminism is to regain the charms of Eternal Youth.' She told me of patients of hers who had become beautiful through faith. One good lady at ninety developed new teeth through belief in Neminism—incisors, cuspids, bicuspids, and one molar. A gentleman at sixty had retained his full set of upper and lower teeth without a decaying cavity.

"On her card were these words:

"'N. N. N. The receipt for Beauty is to have less Illusion and more Soul. *Nihil nemini nocet.*'

"And, as the final ceremony was passed, the president looked almost beautiful herself.

"On the tenth day the president gave some account of her early studies and of the origin of Neministic Healing.

"'While from the human standpoint I inherited the refinement that goes with culture of family and moral rectitude, as usual here in Boston, yet there was a marked degree of spiritual Grace, Soulful Delicacy, and Esoteric Elegance that comes not from human ancestry, neither from communion with Nature. It was the exquisite coloring of the touch of the astral hand which opens the petals of thought as it does the opening rose. This ended in a soft glow of ineffable Joy, and out of its perfect serenity Neministic Science was born.

"'The discovery was so new, the basis laid down for physical and moral health so hopelessly original and men so unfamiliar with the subject, that not until later did I venture to proclaim it to the world.'

"On the card was—

"'N. N. N.

"'My world has sprung from Spirit
In Everlasting Day;
Whereof I've much to glory,
Wherefor have much to pay.'

"Under this was a picture of the egg of a vulture, in which, through his microscope, Agassiz once saw the sun, moon, stars, and the gathering of clouds. '*Nihil nemini nocet.*'

"At the eleventh lesson I was directed to go out for clinical practice. In my hotel I found a dear little six-year-old boy who had been invited, with the rest of a kindergarten class, to attend a picnic.

"He did not feel that he wanted to go. He seemed dumpish, and, according to mortal belief, was not well. At noon he said that he wanted to go to sleep. I took him in my lap and began to read to him from Neministic Science and Astral Health with a Key to the Stars. Very soon he expressed a wish to go to the picnic, and did go. So I gave him a little card, with the words '*Nihil nemini nocet,*' and all day he said nothing more about being sick.

"Next morning the president gave me an account of various wonderful cures in her experience. Among others, she showed me a letter from John B. Higgins, of Little Egg Harbor, N. J. This I copied down as follows:

"'I am glad to tell you how I was healed. Beliefs of consumption, dyspepsia, neuralgia, ulcers, tobacco, and bad language. . . . Doctors that were consulted did nothing to relieve me, and I constantly grew worse. Nearly two years ago you told me that if I would read a book called Neministic Science and Astral Health with a Key to the Stars, I would be healed. I told you I would go into it for all it was worth, and I found that it is worth all. I got the book and read day and night. I saw that it must be true, and believed that what I could not then understand would be made clear later. After some days' reading I was afflicted with drowsiness, followed by vomiting. This lasted several hours, when I fell into a sleep. I awoke healed.'

"The president assured me that if I would spend no time in intellectual drifting, adhering to the impersonal and scientific deductions of the one discoverer to whose clarified spiritual eye all truth of the mind had been revealed, with all the loyalty of a mathematician to the principles of mathematics, I would be sure of a comfortable fortune. Although money had no real existence, the shadow in its substance proved that there was after all substance in its shadow. The Neministic Healer is at no expense for books or instruments or medicine, providing always that the one perfect Key to the Stars (including Neministic Science and Astral Health) lies open before him. With that in sight he can

not go wrong, and with perfect faith in the unreality of all external things it matters not in earthly affairs what he does or leaves undone.

"The card for this lesson was:

"'N. N. N. The population of our cities is ample to supply many practitioners, teachers, and preachers with work. To enter this field of labor beneficially to ourselves, it is necessary to demonstrate that *the patient who is able to pay for being healed is more apt to recover* than he who withholds a slight equivalent for health! *Nihil nemini nocet.*'

"At the last lesson the president informed me that my course of instruction was complete, and that I must now go forth and bless the world. I must lean no longer on her personal leadership, but, trusting in the spirit, I should rest solely on the pure Mentiphysical principle at work. As a pioneer of Neministic Healing in the far uncultured West, I must stand alone in the conflict, smiting error with the falchion of Truth. The rare bequests of the spirit are costly, and they have won fields of battle from which the dainty borrower would have fled.'

"I spoke once or twice of my diploma, without which I could not practice my profession under the laws of Fresno County. At first she made as if she did not hear me, but at last she said:

"'The Massachusetts University of Mentiphysics draws its breath from me, but I yearn for retirement. No one else can sustain this institution amid the legislation aimed at its vital purpose. This has given me conscientious scruples about diplomas, and, with the growing conviction that every one should build on his own foundation, no more diplomas shall be issued from this flourishing school.

"'But do not worry, dear,' she said. 'Your power is just the same with or without diploma. You can make known the rare bequests of the Spirit quite as well as a martyr as you could as a physician. The faithful will stand by you. Those who believe will always pay. Take this locket, and hang it about your neck. It will contain the quintessence of all my teachings, and with this in your right hand and Neministic Science and Astral Health with a Key to the Stars in your left, you will drain the cup which I have drained to the dregs as the discoverer and teacher of Neminism, and without tasting this cup its inspiration can not be gained.'

"Then I took the little locket, and here it is. On one side are the letters D. N. N. N., 'which,' she said, 'makes its holder a doctress.' On the reverse is the face of Lydia Pinkham, while around the margin, in fine gilt letters, is a scroll with the motto, '*Nihil nemini nocet.*' Mr. Gridley, the learned professor of

our Alcalde school, says this means 'nothing hurts nobody.' But I am sure that there is more in it than that; besides, whatever it is we can prove it by inversion: *Nihil nocet nemini; nihil nemini nocet*—one is true like the other, and its symbolic significance is proved by its three N's, for N is the symbol of eternity. At least, this is what the president told me. But now that I am back in Alcalde, the whole thing seems like a dream, while all the things I had learned to call dreams seem more real than ever. Maybe I am still on the Material Plane after all, in spite of all I have done and all the rest of us in Alcalde are doing to try to rise above it."

DEVELOPMENT OF THE AMERICAN NEWSPAPER.

By WALTER L. HAWLEY,
OF THE NEW YORK EVENING SUN.

At the beginning of the present century the newspapers published in the United States numbered 200—one for each 26,450 of population—while at the present time the total of regular publications slightly exceeds 20,000—one for each 350 inhabitants of the country; and in that growth and development of the business is represented more of science and art, more of physical ingenuity and mental activity, than in any other line of human endeavor. One hundred years ago the publication of a newspaper did not rank as a business, and the preparation of its contents was regarded as a pastime or the indulgence of a whim, rather than a profession. At the end of the century, journalism is the history of the world written day by day, the chief medium of enlightenment for the masses, the universal forum of scholar, sage, and scientist. As a business enterprise, the newspaper of to-day commands unlimited capital, and as a profession it ranks second to none.

For three centuries and a half following Gutenberg's invention of type little progress was made in the art of printing, and the production of a newspaper in this country in 1800 was accomplished with crude machinery and involved much slow and difficult hand labor. The printing was done on wooden presses of primitive pattern, the type was large and ill formed, the paper used was in many cases inferior to the lowest grade made at the present time, and the production of a large number of copies of any issue was out of the question. No attempt was made in this country to publish a daily paper until 1784, and in 1800 daily editions were issued only in four or five of the larger cities.

The publications of that period were not newspapers in the sense in which the word is now used, because no particular effort was made to present an account of the happenings of the day. Notices of the arrival and departure of ships, time tables of mail coaches, and brief announcements of matters of political interest filled the limited space devoted to domestic news. Foreign news consisted entirely of matter reprinted from the English journals received by sailing vessels, and therefore weeks or months old when it appeared. The wooden presses used a hundred years ago were operated entirely by hand. After the type had been set it was placed in a frame or "form," with little or no regard to artistic arrangement of headlines or displayed matter. To print the edition, the "form" was placed on the bed of the press and ink spread over the type by the use of hand rollers. The white paper was then dampened with water, sheet by sheet, laid over the stationary "form," and the impression was made by pulling down the upper part of the press with a lever. This work was so slow that a circulation of three or four

Hats Loſt !

SUPPOSED to have been left on the wharf at Burling-ſlip, or taken on board of ſome veſſel by miſtake, ſome time in the month of November laſt, SIX Gentlemen's fine HATS, were packed in a Tea Cheſt, and purchaſed of Walter Kenderich, with his Card inſide of the Hats. Whoever will give information where they may be found, ſhall receive a reward of FIVE DOLLARS, by applying to

JAMES CASEY,
dec. 27. 4t no. 164 Front-ſtreet.

Sherry Wine,

OF the noted brands J. H. and D. Q. juſt received per the brig Union, from Cadiz, and for Sale by

D. SMITH and Co.
no. 218 Front-ſtreet, near Peck-ſlip.
december 23. 1m

John Montgomery,

MUSICAL INSTRUMENT MAKER and TURNER,

TAKES this method to inform the public, that he has lately arrived from Charleſton, and has commenced buſineſs

At No. 23 ROSE-STREET,

where he makes and repairs all kinds of Wind and String Inſtruments, in the neateſt manner. He hopes from his experience in the above buſineſs, he ſhall merit the favour of the public in general.

december 14. 3m

TOBACCO.

35 Hhds. of an excellent quality, juſt Landing from Virginia, and for Sale, at low prices, by

JOHN PATRICK,
dec. 21. No. 4 William-ſtreet.

—WHO HAS ON HAND—
Several choice Parcels of TOBACCO.

A Negro Wench for Sale,

AGED about 28 or 30 years, is healthy, ſtrong, honeſt, ſober and induſtrious—has two Children, the one a Boy, in his fourth year, the other a Girl, upwards of a year old—Sold for no fault. To prevent unneceſſary application, the price for the three is 80l. Apply to C. Schultz, jun. corner of Eagle and Fourth-ſtreets, Bowery. 1m dec. 5.

Turks Iſlands Salt.

The ſubſcriber is authoriſed to diſpoſe of from 20 to 100,000 buſhels ſalt, to be delivered at Turks Iſlands, and will contract for it, in any quantity, at the very low price of 15 cents per buſhel, payable in New-York at 60 or 90 days after ſight of the purchaſers drafts.

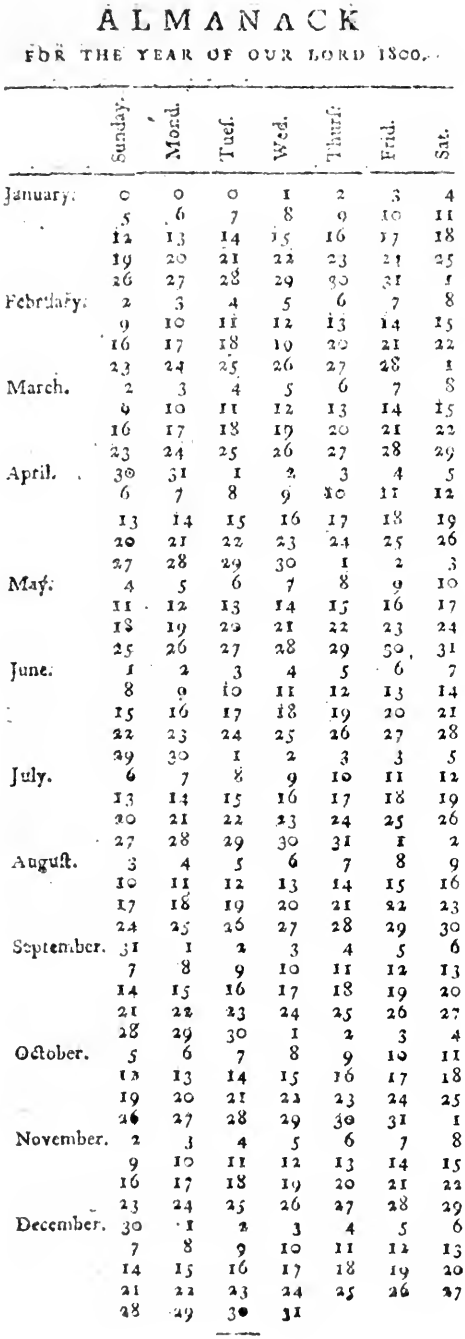
RICHARD I. TUCKER,
oct. 29. 123 Front-ſtreet.

Landing this Day.

At Burling-ſlip, from the ſchooner Raven,

20 hds. fine flav. high proof Geneva

FROM THE NEW YORK GAZETTE AND GENERAL ADVERTISER OF WEDNESDAY, JANUARY 1, 1800.



ALMANACK

FOR THE YEAR OF OUR LORD 1800.

	Sunday.	Mond.	Tuef.	Wed.	Thurf.	Frid.	Sat.
January.	0	0	0	1	2	3	4
	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	29	30	31	1
February.	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	1
March.	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
April.	30	31	1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	1	2	3
May.	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	31
June.	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	1	2	3	3	5
July.	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31	1	2
Auguft.	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
September.	31	1	2	3	4	5	6
	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23	24	25	26	27
	28	29	30	1	2	3	4
October.	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	29	30	31	1
November.	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
December.	30	1	2	3	4	5	6
	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23	24	25	26	27
	28	29	30	31			

FROM THE NEW YORK GAZETTE AND GENERAL ADVERTISER OF JANUARY 1, 1800.

hundred copies of a daily newspaper would severely tax the capacity of the press room. The weekly publications were as a rule limited to about the same figures, because the entire mechanical part of production devolved upon one man, who was often owner and editor as well as printer. Some iron presses were imported from England in 1810, and in 1817 George Clymer, of Philadelphia, invented a lever press that was a marked improvement over the crude machines then in general use, reducing the manual labor required and increasing the speed with which printed papers could be turned out. The first power press used in this country was invented by Daniel Treadwell, of Boston, in 1822, and operated by the American Bible Society, the power being furnished by a team of mules. These presses were not adapted to newspaper work, and the first considerable advance in the mechanical part of the business was made in 1829 and 1830, when a Washington hand press was invented. Seventeen years later a cylinder power press was perfected by Richard M. Hoe, and the mechanical ability to pro-

duce periodicals was more than doubled; but during the time when American ingenuity developed the steam engine, the cotton gin, the sewing machine, and the electric telegraph, the progress made in the mechanism of newspaper making was comparatively insignificant. The process of stereotyping was introduced into this country from England in 1813, and a year later the New Testament was printed from plates, but the discovery was not utilized in the publication of newspapers until 1861.

In the first half of the century journalism did not at any time rank as a profession requiring special training, and capacity, and the returns of the counting room were so meager, the cost of material so high, and the appliances in the mechanical department so imperfect, that the publication of newspapers rose only by slow degrees to recognition as a business enterprise in which capital might seek investment with fair prospect of a satisfactory return. Modeled after English publications, the early American newspapers depended, for whatever of reputation or success

NOW LANDING.
And for fale by BRUNE and ERICH, No 237 Pearl-Street.

Platillas Royal — Choilets or Crown Platillas
Bretagnes — Dowlas
Creas a la Morlaix — Liftados
Rouans — Arabias
Checks and Stripes
Haerlem Stripes and Checks No 2
Vries Bontes — Ofnabrugs
Ticklenburgs — Halflaken and Bagging
German Steel and Iron wares
Claret in Boxes fuperior quality

☞ The above Goods are fubject to foreign drawback.

ALSO ON HAND,
Ruffia Sail Duck — Diapers
87 hhds Mary's Tobacco
Likewife,
Bill of Exchange 406l. 2s. 10d.—60 days on London.
dec 5 — 1m

WANTED,
A Wet Nurfe who can be well recommended Apply at this office. — nov 29 — tf

MACKEREL,
400 barrels arrived this day, and for Sale by
MONSON and JAMES HAYT,
No 140 and 142 Water ftreet.
dec 16

TO LET,
That handfome and completely finifhed three ftory brick HOUSE, No. 168 Greenwich ftreet, lately rebuilt was formerly occupied by Gov. Crawford. For further particulars pleafe to enquire at Mrs. Rogers, no 7 Beaver ftreet.
dec 16 — tf

A Negro Man,
To be fold cheap, he is about twenty years of age may be feen at the Bridewell of this City. Apply for terms at 16 Broadway and 245 Pearl street.
dec 10

LEATHER STORE,
No 255 Pearl ftreet,
J A C O B L O R I L L A R D,
Has on hand a large quantity of flaughter and dryed hide Soal Leather, neats do. wax, grain and ruffet calve fkins, American and Englifh boot and bootee legs, morocco and kid skins of various colours, harnefs and fkirting leather, &c. &c.
dec 16 — 3m

10 cafes mens fine fafhionable black HATS received per the Factor from London. For private Sale by — ISAAC MOSES and SONS.
dec 26

ADVERTISEMENTS FROM THE NEW YORK DAILY ADVERTISER OF WEDNESDAY, JANUARY 1, 1800.

they achieved, upon the fame and ability of the editor. The reporting of current events without comment was a secondary feature of the daily papers, and in the weekly publications it was not attempted. Before the days of railroads and prompt and reliable mail service, communication between men in public life and, in fact, all persons of education, was chiefly by letter. The custom grew into a fixed habit, and to a large extent influenced the character of the newspapers published prior to 1850. The editor addressed himself directly to his readers through long editorials upon topics in which he was interested, and his publication was in reality a mere instrument for the expression of opinions. Public men and politicians were encouraged to write letters for publication upon public questions, and a long communication from a man of national reputation was regarded by the editor as matter of far more value to his journal than any amount of news of the events of the day.

NOTICE

To the Proprietors of Woodland and Boatmen, who ſend and bring Firewood *to this City for Sale.*

THE Common Council, finding that great Fraud is daily committed in the ſale of *Firewood* in this city, eſpecially as it reſpects the length thereof, have directed the following Extract of the Law on that ſubject to be republiſhed, to the end that all perſons concerned may govern themſelves accordingly, and not affect ignorance of the Law. And it is ſtrictly enjoined on the *Inſpectors of Firewood* to cauſe the Law to be ſtrictly enforced from and after the firſt day of April next, on pain of being *removed from Office.*

Extract of the Law.

"That all *Firewood* which ſhall be brought into this city for ſale as *cordwood*, ſhall be in length *four feet*, including half the ſcarf—and that if any perſon ſhall offer for ſale any *Firewood* as *cordwood* which ſhall not be of that length, ſuch perſon ſhall forfeit the ſum of *ſeventy-five* Cents for each Cart-load.

Publiſhed by order of the Common Council.

ROBERT BENSON, *Clerk.*

New York, Nov 11, 1799.

A Municipal Notice from the New York Gazette and General Advertiser of January 1, 1800.

The organization and development of political parties in the early part of the second quarter of the century resulted in a rapid increase in the number of newspapers throughout the country. Party leaders found that they could reach a greater number of citizens by means of published letters and speeches than by the primitive process of campaigning by easy stages from one State or county to another. From writing personal letters to friends in their districts, senators and representatives in Congress found that they could keep their constituents better informed of the progress of legislation and politics by means of signed statements in the press of their respective States. The party organ and the personal journal were the immediate natural results of this condition of public life and politics. Every secular journal supported some political party or organization without qualification, and there was little or no independence of the press. The editor

The Daily Advertiser.

FOR SALE.

FOR LIVERPOOL.

THOMAS DEBEVS,

NOTICE.

DRUGS and MEDICINES

JACOB SCHIEFFELIN.

COTTON and TOBACCO.

Indigo

JOHN FISHER.

NOTICE.

A PUBLIC SALE.

GEORGIA TOBACCO.

found his subscribers among the members of his own party, and often looked to the organization or the candidate for financial support. Papers were established and editors hired by parties, factions, and individual leaders to advocate some particular plan of finance or tariff, or some general policy for the nation or State. During this stage of American journalism the influence of a paper depended largely upon the reputation, individuality, and force of character of the editor. He needed not to possess any particular qualification for the work, except a general knowledge of the affairs on which he was to write and a command of vigorous language to compel attention to his utterances. For many years the majority of the periodicals of the country, daily and weekly, were critical reviews of the events of the time, rather than mediums for the spread of general information. News of important happenings at home spread through all the States ahead of the circulation of the papers, and the people looked to the latter for review and comment upon events, rather than for detailed accounts of the occurrences. Foreign affairs, as reported in the English publications received in this country, took precedence in the classification of news in the journals of the first half of the century, and local events, often matters that were subsequently recognized as of great historical value, were briefly and too often imperfectly recorded. It is a matter to be regretted that in the days when American statesmen and orators were making history for the world, when the new republic, having passed beyond the stage of experiment, was advancing with prodigious strides toward glorious achievements in material development, the journals of the country kept but an imperfect and often inaccurate record of events that should have been reported in full.

During the first forty years of the present century there was no system of collecting the news for publication, and the capital invested in the newspaper business was insufficient to permit of any extra outlay to obtain reports of events occurring at a distance in advance of the regular mails. Such reports as were obtained were usually voluntary contributions written by a friend of the editor, and often colored or distorted according to the prejudice of the writer. These letters were, almost without exception, semi-editorial in character, the writers indulging freely in comment and expression of opinion upon the event they attempted to record, so that no political or public matter was reported entirely free from partisan coloring. The drivers of mail coaches, the captains of coastwise or river vessels, strolling peddlers, lawyers, surveyors, and wandering missionaries, who made long journeys into the interior and from town to town, were the news reporters of early

J. Russell's Gazette.

COMMERCIAL AND POLITICAL.

Published on MONDAYS and THURSDAYS, by JAMES CUTLER, at his Office, in Congress Street, (formerly Quaker-Lane,) BOSTON.

[No. 52, of Vol. VIII.] MONDAY, September 1st, 1800. [4 dolls. per ann.]

Price of Stocks.

8 per Cent. ...	[illegible]		
6 ...	[illegible]	113½ a 114	——
Deferred,	[illegible]	83½ a 84	——
Navy Notes,	[illegible]	[illegible]	——
[illegible]	[illegible]	112 a 113	——
National Bank	[illegible]	[illegible]	——

Course of Exchange.

FOREIGN BILLS. INLAND BILLS.

[illegible]

The above Prices corrected on Saturdays, by WILLIAM CLELAND, Stock and Exchange Broker, ... Congress and State Street.

WHOLESALE

Price Current, at BOSTON.

To which is annexed the ... duties ...

Accurately corrected ... August 29, 1800.

Current Prices of		from D. C.	to D. C.	Cents	DUTIES.
ASHES, Pot ...	T.		100		
, Pearl	—	100 60			
Almonds, soft shell'd	lb	12	15	15	pr. ct. adva
, boxes, shell'd	—	25	33	15	do
Allum,	C.	7	8	Free	
Bread, ship	—	5	6		
Butter, shipping,	lb	16	[illegible]		
Beef, ship stores,	B.	10	13		
, cargo,	—	7	8		
Beans, white ...	bu	1 50	1 75		
Brandy, French,	G	1 10	1 37	25	[illegible]
, Spanish,	—	1 8	1 [illegible]	do	do
, Naples,	—	95	1 5	do	do
Bees Wax,	lb	[illegible]		[illegible]	pr. ct. adva
Cinnamon,	—	2 50	3	15	do
Cloves,	—	1 50	1 [illegible]	10	do
Cassia, do	—		[illegible]	do	[illegible]
Cocoa, Surinam,	C	25		[illegible]	
, Caraccas,	—	28	29	[illegible]	
, Island,	—	[illegible]	[illegible]	do	
Corks, Lisbon	gr	[illegible]	[illegible]		
Coffee,	lb	[illegible]			[illegible]
Copper, in sheets	—	40			
Cotton, Foreign	—	4[illegible]			
, American	—	30	42		
Currants, Zant	—	[illegible]	12	15	pr. ct. adva
Cordage, American	C	12	13	180	[illegible]
Cloth, tow, Amer	yd	[illegible]	[illegible]		
Chocolate, common	lb	[illegible]	[illegible]		
Waitt's No. 2 to 1	—	25	31		
Romney's No. 2 to 1	—	28	31		
W...'s No. 2 to 1	—	28	31		
Candles, tall. mo. Am	—	20	21		
, dips, do	—	18			
, spermac. do.	—	45	dull		
Cheese, English	—	[illegible]	[illegible]	7	cts. pr. lb
, American	—	8	17		
Coal, pit, Foreign,	ch	11	12	5	cts pr. bu
, American	—	14	16		
Cod Lines,	D.	8	9	[illegible]	
Duck, Russia, dull	Bt	12	17	[illegible]	pr. ct. adva
Ravens,	—	10	11		
FISH: Table,	C	4	8		
Merchant,	—	[illegible] 50	4		
W. India, mark.	—	3	3 [illegible]		
Scale,	—	2 25	2 33		
Alewives, best	B	3 17	4		
Salmon,	—	8	[illegible] 50		
Herrings,	—		3		
Mackerell, bay,	—	6	7		
, N. Scotia	—	5	5 50		
FURS: Beaver, pelt,	lb	1 [illegible]	3 31		
Bear,	Sk	83	4 [illegible]		
Fox, cross	—	1 [illegible]	[illegible]		
, red	—	[illegible]	1 [illegible]		
Minks,	—	12	[illegible]		
Musquash,	—	15	[illegible]		
Otter,	—	1 [illegible]	4		
Sables,	—	35	[illegible]		
FLOUR: Super fresh,	B.	[illegible]	[illegible]		
Fine,	—	[illegible]	[illegible]		
... Bread,	—	[illegible]	[illegible]		
Middlings,	—	[illegible]	[illegible]		

Current Prices of		from D. C.	to D. C.		DUTIES
Feathers, live Geese	lb	[illegible]			
, Lisbon,	—	12	16	12	pr. ct. adva
, Sea Fowl,	—	[illegible]			
Figs, frail,	—	[illegible]			
Flaxseed,	—	[illegible]	9		
Gun Powder,	—	[illegible]	[illegible]		
Geneva, Holland,	—	[illegible]	[illegible]		
[illegible]					

Current Prices of		from D. C.	to D. C.		DUTIES
[illegible]			13	4	cts. pr. lb
Pitch,	—	5	[illegible]		
Paper, Sheathing,	—	4			
, W...	—	[illegible]			
, sugar ...	—				
Raisins, ...	—	9	9 [illegible]	15	pr. ct. adva
RUM: Jamaica,	—	1 18	1 [illegible]	25	[illegible]
West India,	—	1 8	1 10		
New England,	—	60			
Russia Sheetings,	—	16 50	17 50	[illegible]	pr. ct. ad.
Rice,	C		6		
Rosin, ...	—	60	80	Free	
Rotten stone	—	3	3 [illegible]		
Salt Petre, Rough,	—	16	[illegible]	Free	
, Refined,	—	25	30	do	
Soap, Ameri. white,	—	14			
, brown,	—	8	11		
, Castile,	—	18			
Starch, Poland, best	—	25		15	pr. ct. adva
, American,	—	14	16		
Sugar, Havanna white dull	C	15 50		3	cts. pr. lb.
, brown dull	—	11 50			
, East India,	—	12	13	[illegible]	
, W. India,	—	7	13		
, Loaf,	lb	25	26	[illegible]	
SALT: St. Ubes,	B[illegible]	5	5 33		
Lisbon	—	5	5 33		
Cadiz,	—	4 75	5		
Liverpool,	—	4 8[illegible]	5		
Steel, German	lb	13	20	[illegible]	cts. pr. cw
, Tubb,	—	10	12	do	do
, Blistered,	—	9	15	do	do
Shot, all sizes,	C	7	8	1	ct. pr. lb
, Patent,	—	9		1	do.
STAVES: W. Oak pipe, ...	M	55	60		
, hhd	—	25	28		
, head	—	25	30		
, bbl	—	18	20		
R. Oak, hhd	—	12			
, Shooks,	—	[illegible]	1		
[illegible]	—	1	1 [illegible]	dull	
Spirits of Turpentine	—	[illegible]	1 50		
Tallow, Foreign,	—	11	13	12½	pr. ct. ad.
, American,	—	14	15		
Tea, ...	—	5	6		
[illegible]	—	3	3 5[illegible]		
, Bohea,	lb	35	3[illegible]	12	cts.
[illegible]	—	1	1 9	18	do
, Hyson,	—	1 [illegible]	1 25	32	do.
[illegible] James R[illegible]	—	5	5 50		
, Georgia	—	4	4 75		
, Maryland,	—	4	4 [illegible]		
[illegible]	—	5	6		
[illegible]	—	5	6		
Wine, Lisbon, ...	—	5[illegible]	55	Free	
, Malaga,	—	10	17		
, Teneriffe,	—	55	50		
Lignum Vitæ,	—	4[illegible]	50		
Whalebone, ...	—		10		
[illegible]	—		8		
WINE: Madeira,	—	1 [illegible]	2 65	58	cts. gal
, Lisbon,	—	1 4	1 10	30	do
, Sherry,	—	1 1	1 [illegible]	40	do
, Teneriffe,	—	[illegible]		28	do
[illegible]	—	[illegible]		40	do
Cordial ...	—	[illegible]	[illegible]	40	pr. ct. adva
French ...	—	[illegible]	35	40	
Molasses,	—	[illegible]	41	28	cts pr. gal.
Red Port, ...	—	1 [illegible]	1 15	90	

[illegible]

Political Miscellany.

[illegible]

THE ... OBSERVER

[illegible]

...ample, by the heart of virtue. Who for the deluded, or deluding, can have the ... to the ... Who ... as the ... of the people, ... be ... to the ... If ... judgment to the ... the ... of the people, ... of the ... America ... "... We ..." ... shall be ... Whatever be ... of ... is the ... guide shall be ... What ... of every ... American ... What ... [illegible]

[illegible]

A Young Man ... [illegible]

[illegible]

At No. ... [illegible]

A Beautiful ... [illegible]

[illegible]

THE Copartnership of ... [illegible]

... NATHAN ... [illegible]

... BOARDING ... [illegible]

J. ... [illegible]

days. When they arrived in a city or town they would tell the latest news from the places they had visited, and the next issue of the local paper would contain a story beginning, "The Rev. Mr. Bland, the traveling missionary, relates," etc., or, "Captain Smith, of the schooner ——, reports having heard," etc. Information received in this way might relate to Indian uprisings, fires, floods, crimes, accidents, or political events; but in every case the published account would be interspersed with opinions of the narrator and the comments of the editor who prepared the story for publication. For news of events happening in the larger cities, the journals of the first half of the century depended almost entirely on reprinting from exchanges. They had no regular correspondents anywhere, and a paper published in New York would reprint from the papers of Boston and Philadelphia such of the news of those cities as impressed the editor as being of more than local interest. During the War of 1812, the subsequent Indian wars, and the conflict with Mexico, news of battles and movements of armies in the field was obtained by the slow process of waiting for official reports to the Government or private letters from officers and men at the front. The Mexican War stimulated the public demand for news, increased the circulation of newspapers, and did more than any other event up to that time to arouse the editors of the country to the fact that the people wanted early and complete information of what was going on in the world, rather than individual opinions on general problems. While that struggle was in progress the arrival of the weekly mail in a remote village was an event of importance. The inhabitants would gather in large numbers at the post office, and the meager war news contained in the newspapers would be read aloud. The postmaster or some subscriber to a paper would often post a copy of the latest journal in some conspicuous place in the town, and from that simple beginning there was developed the newspaper bulletin board, where the public may obtain brief information of great events before the full report can be put in type.

After the division of the voters of the country into organized political parties, the tariff, banking and currency, the acquisition of additional territory, and States rights developed into great national questions, precipitating prolonged and heated discussion by the statesmen of that period. This condition stimulated the growth of a certain class of newspapers, and brought into prominence many writers of ability. The statesmen and politicians of that time turned to the press as an available and valuable medium through which to disseminate arguments. They sought to con-

vince rather than to inform the public, and the journalism of that period made no substantial progress except as an instrument for the development and exploitation of writers of force and influence. Whatever power the press exerted in shaping events, whatever it accomplished in swaying the public mind in the days when nullification was scotched and territorial expansion was accepted as a fixed policy of the majority, should be credited to the genius and individuality of the leading writers of that time, rather than to a full presentation of facts. The years of agitation of the question of slavery still further developed individuality in journalism. The newspaper became an instrument for educating the people on certain public questions, and an influence upon public opinion by means of editorial writing. That was the period of so-called great editors, of whom Horace Greeley may be mentioned as a conspicuous example, who made and unmade politicians with their praise or criticism, who shaped the policy of political parties, controlled conventions and nominated candidates, changed the current of their country's history at critical points, and in many ways wielded an influence in public affairs greater than that of the leading statesmen. The editor of that time was greater than his newspaper, and the power

TROY, LANSINGBURGH AND WATERFORD

NAVIGATION LOTTERY.

SCHEME.

1	Prize of 20,000 Dollars, is	20,000
1	10,000	10,000
1	5,000	5,000
1	2,000	2,000
3	1,000	3,000
20	500	10,000
60	200	12,000
150	100	15,000
340	50	17,000
600	20	12,000
9,600	10	96,000
1	First drawn number	1,000
1	do. on the 5th day	1,000
1	do. 10th day	1,000
1	do. 15th	2,000
1	do. 20th	2,000
1	do. 25th	2,000
1	do. 30th	2,000
1	do. 35th	3,000
1	do. 40th	3,000
1	do. 45th	5,000
1	do. 50th	1,000
10,788	*Prizes.* *Dollars*	225,000
26,712	*Blanks.*	
37,500	Tickets at 6 Dollars, is *Dlls.*	225,000

Subject to a Deduction of 15 per cent.

☞ Less than two and an half Blanks to a Prize.

The Managers will certainly commence drawing in the City of New-York, *on the first Tuesday in May next*, and will continue to draw 750 Tickets each day until completed, as they have disposed of the LOTTERY to a Company of Gentlemen in this city, who are to sell the Tickets at the original price of *Six Dollars*, until the first of December.

This Lottery is for the purpose of raising *Thirty Thousand Dollars*, to improve the Navigation of Hudson's River, between the City of Albany and the Villages of Troy, Lansingburgh, and Waterford--Agreeably to Three several Acts of the Legislature of this State.

DAVID GELSTON,
PHILIP TEN EYCK, } *Managers.*
JOHN BORDMAN,

The Tickets in the above Lottery are for sale at GAIN & TEN EYCK's Book-store, No. 148 Pearl-street.——Prize-Tickets in the New-York State Road Lottery taken in payment. Nov. 16 · tf

FROM THE NEW YORK EVENING POST OF NOVEMBER 16, 1801.

of the press was in reality the force of character of the individual exerted through the instrument within his control.

From 1830 to 1860 the progress made in the mechanical department of the business was slow and unimportant in comparison with recent inventions. Cylinder presses came into general use for the printing of daily papers, but the weekly and monthly publications continued to use the primitive hand machines. The speed of presswork was still limited to a few hundred copies per hour, so that an extensive circulation could not be supplied even if there had been a demand for it. The white paper used was still made entirely of rags, and most of the material was imported from Austria and Italy. The cost of production was high, and few newspapers in the United States were published at a fair profit. The uncertainty of the financial returns from the business greatly retarded its development. Inventors found that their ingenuity would receive more substantial rewards in other fields, and editors and publishers were rarely practical men who could discover imperfections in mechanism and suggest improvements in their own shops. Throughout the first half of the century most of the im-

BROWN & STANSBURY,

No. 114 Water-Street,

HAVE just received a valuable collection of BOOKS, among which are

Large and elegant Family Bibles with plates,
The works of William Penn, the founder of Pennsylvania, complete,
Barcley's apology for the people called Quakers—with a number of books of the same description.

Blair's Sermons,
Do. Lectures,
Goldsmith's Animated Nature.
Darwin's Zoonomia,
——— Phytologia,
American Preacher,
Coxe's Switzerland,
Beaujour's History of Greece,
Goldsmith's Greece,
Chatham's Life,
Homes' Sketches of the History of Man,
Smith's Wealth of Nations,
Taplin's Farriery,
Prayer-Books,
Rumford's Essays,
Burns' Works,
Thompson's Works,
St. Pierre's Voyage,
———Studies of Nature
Jefferson's Notes, (hot-pressed,)
Potter's Antiquities,
Archer's Sermons,
Franklin's Sermons,
Court of Berlin,
Bourgannes' History of Spain,
Burk's Works,
Reid's Essays,
Bell on Wounds,
System of Anatomy,
Fourcroy's Chemistry,
London Practice of Physic—with a great variety of Books of the above description.
Durnford and East's Reports,
Blackstone's Commentaries,
Reports of Cases argued and determined in the Court of King's Bench in Hilary Term, in the forty-first year of the reign of George 3d. 1801; by E. Hyde East, parts 1 & 2.
Park on Insurance,
Lex Mercatoria Rediviva, &c. &c.
The Oriental Navigator,
American Coast Pilot,
Jackson's Book-keeping.
New Practical Navigator,
Walsh's Mercantile Arithmetic,
A System of Exchange with almost all parts of the World, to which is added, the India Directory for purchasing the Drugs and Spices of the E. Ind. &c. This is a new and valuable book, and has never before been advertised.

THEY HAVE LIKEWISE ON HAND,

A large assortment of MERCHANTS ACCOUNT BOOKS to various patterns, patent-lined. —All orders in this line duly attended to.

A large assortment of WRITING PAPER of all descriptions, with every article used in counting-houses—140 dozen of LEATHER for Book-binders, for sale on moderate terms.

N.B. BOOK-BINDING done in the neatest manner. Nov. 16

A BOOKSELLER'S ADVERTISEMENT FROM THE NEW YORK EVENING POST OF FRIDAY, DECEMBER 11, 1801.

proved methods of printing were developed in the establishments of book and job printers. There new presses and all new mechanical devices were first installed, and the newspaper followed, instead of leading, in the work of material progress in the art.

To the New York Herald is generally credited the departure from old-time methods that resulted in the creation of newspapers devoted entirely to the publication of news, the reporting of the happenings of the world day by day. The innovation was not well received by the editors, who believed that the public cared more for opinions than a record of events. The new method proved popular, however, and the development of the newspaper from the personal journal and party organ dates from that time. The founder of the Herald and the new school of journalism spent money to obtain the news of the world ahead of the ordinary channels of communication. He established a system of special couriers, employed correspondents, and made the collection of reports of events of general interest a matter of first importance in the business of making a newspaper. Other editors followed the new movement slowly, and often with much doubt and hesitation, but those who stood still and refused to supply their readers with the news were in time compelled to go out of the business.

AN EDEN MUSÉE OF 1801. FROM THE NEW YORK EVENING POST OF DECEMBER 23, 1801.

When the civil war began the new order of journalism had progressed far enough to create a general demand for a full report of the progress of that great conflict. All the larger cities of the country were connected by railroads and telegraph lines, the political agitation for five years prior to the beginning of hostilities had aroused the people to a feeling of intense interest in the struggle, the circulation of the daily papers had increased almost to the limit of their mechanical capacity, and every condition favored a rapid development of the business with a certainty of profitable returns. The leading editors of the country still exerted a far-reaching influence in public affairs, and they were consulted by

NEW-YORK EVEN[illegible]

No. 1. MONDAY, NOVEMBER 16, 1801.

PROSPECTUS OF THE NEW-YORK EVENING POST.

THE Editor will endeavor that this Paper shall appear in a dress worthy of the liberal patronage which is already promised.

As it must derive its principal support from the Merchants of our City, particular attention will be bestowed on whatever relates to that large and respectable class of our fellow-citizens. The earliest Commercial Information will be industriously collected, and faithfully presented; and we hope that our advertising department may, for convenience, neatness, and accuracy, vie with any in the city.

The design of this paper, is to diffuse among the people correct information on all interesting subjects; to inculcate just principles in religion, morals and politics; and to cultivate a taste for sound literature.

Though we openly profess our attachment to that system of politics denominated FEDERAL, because we think it the most conducive to the welfare of the community, and the best calculated to ensure permanency to our present form of government, yet we disapprove of that spirit of dogmatism which lays exclusive claim to infallibility; and willingly believe that honest and virtuous men are to be found in each party. Persuaded that the great body of the people of this country only want correct information, to enable them to judge of what is really best, and believing that nothing will so directly conduce to this desirable end, as candid and liberal discussion; this paper shall be equally free to all parties. All Communications, therefore, shall be inserted [illegible] spects the name of the author; reserving, however, the right of subjoining a reply whenever we shall consider it necessary or proper. But it would be inconsistent with the rules which we have prescribed to ourselves, not to declare explicitly that we never will give currency to any thing scurrilous, indecent, immoral, or profane, or which may contravene the essential principles of social order.

While we shall be duly studious of Originality, we shall avail ourselves of the contents of the various News-papers, Pamphlets, Magazines and Reviews printed in our own country, or elsewhere, since it cannot be of any moment, as it respects the public, whether an interesting piece of information, or a well written [illegible], which they have probably never seen, has appeared in any other paper or not.

In a word, as our great design is to disseminate those just principles, which are the best and indeed [illegible], we shall keep a steady eye upon this our primary object, and shall neglect no means by which we may think it will be best promoted.

Having thus given a general outline of our Plan, we think it needless to make an elaborate display of professions: We rely for support on what shall be the intrinsic merit of the paper itself.

As it is necessary that the Editor should exercise his [illegible] the propriety of inserting any [illegible] Communications, it will relieve him from an unpleasant embarrassment in this part of his duty, to have them transmitted to him without the names of the Authors.

WILLIAM COLEMAN, *Editor.*

POSTSCRIPT.

There will be attached to the above daily paper,

THE NEW-YORK HERALD,

to be published [illegible] and [illegible], intended as a COUNTRY PAPER [illegible] *Three [illegible] Half Dollars* per annum, payable at the end of every six months [illegible] of which timely notice will be given.

FOR SALE BY HOFFMAN [illegible] TON,

TWELVE Hhds. assorted Glass Ware, [illegible]

FOR LONDON,

The staunch regular trading ship JULIANA, [illegible] Roth, master, will be dispatched in 10 or 12 days, having half her cargo on board. For freight or passage, having superior accommodations, apply on board at Old-slip, or to

COIT & WOOLSEY,
9[illegible] Murray's-wharf,

Who have received per ship Mercury from Liverpool.

A consignment of DRY GOODS, which will be sold at a moderate advance, consisting of 2 bales Coatings, 4 do. Rose Blankets, 10 cases Hats, 4 do. Hosiery, and 20 trunks Calicoes, Chintzes, Quilting, Muslins, Velverets, Corduroys, Hankersets, &c. &c. Nov. 16.

FOR CALCUTTA,

The well known ship CITIZEN, [illegible]C. Blakeman, master, burthen 28[illegible] tons, was built in Philadelphia of live oak and red cedar, and coppered in Liverpool about 11 months since, and in every respect is well fitted for the voyage, and is intended to be dispatched with all convenient speed. She will take on board merchandize or specie [illegible], and will return direct to this port with goods, the manufacture of that country, to which effect she will be provided with a Supercargo, competent to the business of the voyage; and it is probable she may touch on her outward passage at Teneriffe, 100 or 200 pipes of wine will there be received on freight, if a contract for the same is made before sailing from here. For terms of which, or freight, or passage direct to Calcutta, apply to HOYT & TOM.

WHO HAVE FOR SALE,

600 boxes Havannah Sugars assorted
150,000 Spanish Segars, 50 crates Earthen ware
2 hhds. and [illegible] bbls. St. Croix Sugars.
Nov. 16.

FOR HULL,

The British brig MINERVA, captain M'Bride. Said brig lays at [illegible] wharf, and will sail the [illegible] of December. For freight or [illegible], apply to the captain on board, or to

JOHN [illegible]NOX,
Nov. 16. No. 97 Water-street.

FOR GREENOCK,

The good and substantial British Brig RECOVERY, D. Campbell, master, will sail with all [illegible] dispatch having a considerable part of her freight now engaged. For the remainder, or Passage, apply to the master on board, at the wharf adjoining the new bath, north river, or to

SMITH and WYCKOFF,
Nov. 16. No. 211 Pearl-street.

FOR AMSTERDAM.

The ship MAGNET, Thomas Marsh, master, a substantial good vessel, burthen about 500 tons, and will be ready to take on board in a few days. If immediate application is made, the freight will be taken on very moderate terms; for which, or passage, having good accommodations, apply to

SMITH & WYCKOFF,
Nov. 16 No. 211 Pearl-street.

FOR BORDEAUX,

The brig HUNTER, lying at White's wharf, Southstreet, is now ready to take in, and can be dispatched in ten days. For freight or passage apply to
Nov. 16 WM. SETON

FOR MARTINIQUE,

Five Hundred barrels will be taken on freight in a good vessel, for Martinique, if [illegible] application is made to SUYDAM & WYCKOFF,
Nov. 15. No. 21 South-street.

For Norfolk and Richmond,

The remarkable fast [illegible] [illegible] LION, William [illegible] [illegible] [illegible] of ten days. For freight or passage, having [illegible] accommodations, apply on board, at [illegible] coffee house slip, or to

BETHUNE & SMITH
Nov. 16. [illegible]

FOR SALE,

The ship [illegible] from Waterford, [illegible] market, burthen [illegible] about [illegible] stows well, [illegible] board. For terms apply to
Nov. 16. GOUVERNEUR & KEMBLE.

FOR SALE,

RUSSIA GOODS. The [illegible] Oliver Ellsworth, Joseph [illegible] St. Petersburgh, consisting of [illegible]

FOR SALE or CHARTER,

The schooner NEW-YORK, burthen [illegible] tons, built of live oak and cedar, and in every respect a staunch good vessel. For terms of sale apply to

JOHN OZUILT, 9 Beekman-street, or
RICHD. I. TUCKER, 103 Water-street.

14 boxes Havanna brown sugars, and
2 tierces arrow root, are offered for sale on liberal terms, by RICHARD I. TUCKER. Nov. 16. 2w

---

For Sale, Freight or Charter,

The remarkable fast sailing ship SALLY, burthen about 265 tons—stows well, and in every respect a complete vessel. For terms apply to

ROBERT I. THURSTON,
Nov. 16. tf. No. 2[illegible]7 Water-street.

For FREIGHT or CHARTER,

The ship [illegible]M, Captain Jocelin, burthen 14[illegible] tons; a fine vessel, sails fast, and is well found; will be ready to receive a cargo in 12 days. For terms apply to JAMES & [illegible] WATSON,
No. [illegible] or 44 Broad-street.

Who will [illegible] a day or two,

63 hhds. Jamaica Rum of high proof,	13 bales Natchez Cotton,
650 Cherry and Walnut Plank & Scantling,	2 bbls. Beaver Fur,
	41 hhds. good Sugar for retailing.

THEY HAVE ALSO FOR SALE,

250 boxes Brown Soap [illegible] Mould Candles	260 firkins Butter, of the best quality, for shipping.
50 bbls. Boston Beef,	
[illegible] sides Soal Leather.	

Nov. 16

For FREIGHT or CHARTER,

The Ship VENUS, Lemuel [illegible]Bance, master, burthen 299 tons.—Apply to
Nov. 16. WILLIAM NEILSON & Co.

For FREIGHT or CHARTER

for the West-Indies,

The brig GENIUS, burthen 90 tons, Daniel Cornwall, master—a remarkable fast sailer. Apply to the captain on board at Old-slip, or to

JOHN MURRAY & SON,
Nov. 16. No. 269 Pearl street.

FOR FREIGHT or CHARTER,

The new and substantial British ship CH[illegible]LES, James Moyes, master, burthen per register 2[illegible]0 tons (will carry 400 tons). She is on her first voyage. Please apply to

JOHN MAC GREGOR,
Nov. 16. [illegible] Broad-way.

For FREIGHT or CHARTER,

The ship NEPTUNE, burthen about 400 tons, stows well and is in complete order for sea. For terms, Apply to MINTURN & BARKER.
Nov. 16.

FREIGHT

For [illegible] or Hamburgh,

The [illegible] Captain [illegible] is ready to receive [illegible] of the above places, if application is made to the Captain on board, at Gouverneur's wharf.
Nov. 16 GOUVERNEUR & KEMBLE.

WANTED TO CHARTER,

Three or four vessels, drawing under [illegible] feet water, to load with lumber at Newbern, N. Carolina, for Jamaica. Apply
Nov. 16. [illegible] STOCKHOLM.

For FREIGHT or CHARTER

[illegible]

The ship NANCY, burthen about [illegible]

JOHN MURRAY & SON,
[illegible]

FOR CHARTER,

[illegible] FRANCIS [illegible]

[illegible]

FOR SALE,

[illegible]

[illegible] SMITH,
[illegible]

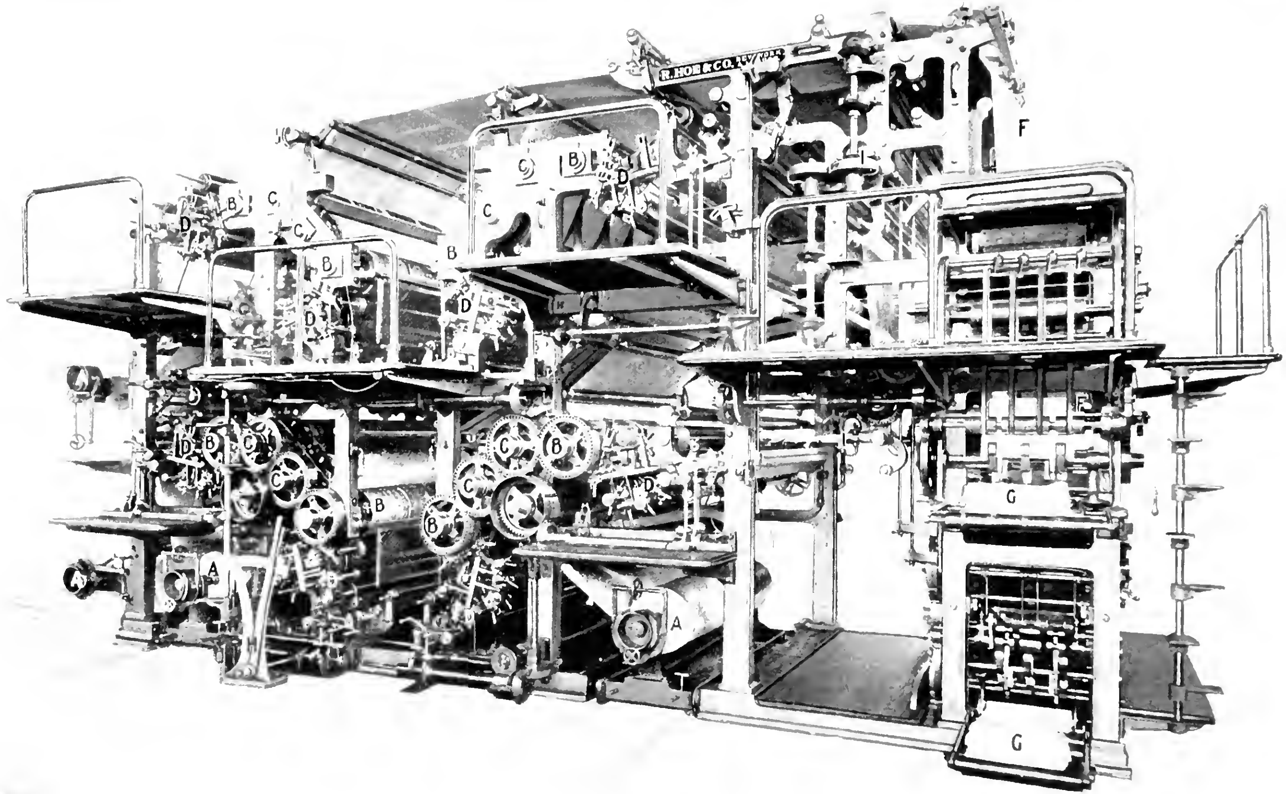
the highest officers of the Government; but the time had come when the people wanted the news, rather than individual opinions. American genius and ingenuity responded promptly and adequately to the demand, and from the time of the civil war the development of the newspaper has been a marvel of science and art. The telegraph came into general use for the transmission of news, correspondents and artists were sent to the front with all the armies, the men employed in Washington to write their own views of public questions were instructed to send to their papers only a record of the great events then transpiring around them, and in a month, or at most a year, American journalism was well advanced upon a new era of marvelous development. The time when the opinions, the power in phraseology, or the individuality of one man could alone make a daily newspaper a financial, literary, or political success had passed. The press had become an institution, journalism a profession, and the publication of newspapers a practical business requiring and rewarding enterprise and sagacity.

With the sudden demand for more papers came rapid progress in the mechanical department of the business. Double cylinder presses capable of printing twenty thousand papers an hour were soon perfected, folding machines came into general use, stereotyping was employed to save time, labor, and wear of type, white paper was made from wood pulp at greatly reduced cost, and the progress in all departments of the business was by leaps and bounds until every demand was more than supplied and new expectations created. From that time forward invention kept pace with every increase of circulation. As soon as one press was found inadequate or imperfect, the manufacturers were ready to set up a faster and better one. As competition reduced the selling price of the newspaper, invention supplied every demand for the material of production at a reduced rate. The impetus to circulation imparted by the civil war created a new reading public, which rapidly grew to include every person who could read and a demand for all the news of the world once created would not be denied. The collection of news was quickly reduced to a system and perfected, until to-day no event of importance occurring in any part of the world is omitted from the daily record of current history.

The great cost of collecting news at the front and transmitting by telegraph full reports of battles during the civil war caused certain newspapers in New York city to enter into an arrangement to receive reports in duplicate and share expenses. Then the cost was further reduced by selling the news to papers in other cities. That was the beginning of the Associated Press, a plan

of newspaper combination that ultimately made the buying and selling of news a great commercial enterprise. Within a few years after the close of the war this system had been developed until practically all the daily newspapers of the country were interested in it or subscribers to the news collected and sold. This feature of the business continued to grow until agencies for the collection and transmission of news were established throughout the world. Similar associations were formed in England and on the continent of Europe, and news exchanged with the American organization. In the United States the business was developed until newspapers of particular sections of the country and even those of single States formed associations on the principle of mutual benefit for the collection of full reports of all important events within the territory where they circulated. At the present time the system has been perfected until the great news agencies of the country receive reports of important events from every quarter of the globe with a degree of promptness and accuracy rendered possible only by thoroughness of organization and the constant exercise of the keenest intelligence. The collection of all the news of the world would not be possible under any other plan, but the American newspapers, having created a demand for the news, were the first to devise a system of obtaining it promptly at a cost that made possible the publication of daily papers at a profit in almost every town in the country. Brief reports of all important events are transmitted by cable or telegraph to a central office in New York, Washington, or Chicago, where they are condensed or elaborated, as occasion may require, and then sent out over special telegraph wires to papers all over the country that are subscribers to the service. The larger papers of the country, however, do not rely upon this service alone. They are represented by special correspondents not only in all the chief cities of the United States, but in London, Paris, Berlin, and other news centers of the Old World.

The development of the newspaper into a medium for recording day by day every event of human interest was so rapid during the civil war and the stirring times immediately thereafter that many faults of form and detail remained. The journalism of that period was a new departure, and the men who created it had no precedent to guide them, but all the time there was a steady and intelligent effort to improve in all directions. The efforts of the leading men in the profession, influenced by conditions and surroundings, resulted in the creation of what were for a time known as schools of journalism—that is, one man set up an ideal, and another man strived to create a journal of another character. The



Octuple Stereotype Perfecting Press and Folders (printing on both sides of the paper). Capacity 96,000 4-, 6-, or 8 page papers per hour; down to 24,000 24-page papers per hour. A, paper rolls (Webb's), sometimes five miles long; B, printing cylinders, each one carrying sixteen plates (pages); C, blanket or impression cylinders; D, inking motion (fountain and inking rollers); F, folding mechanism or formers (four of these); G, deliveries (four of these); H, controlling lever; I, bar slitting, pasting, collating, and collecting devices (between press and folders).

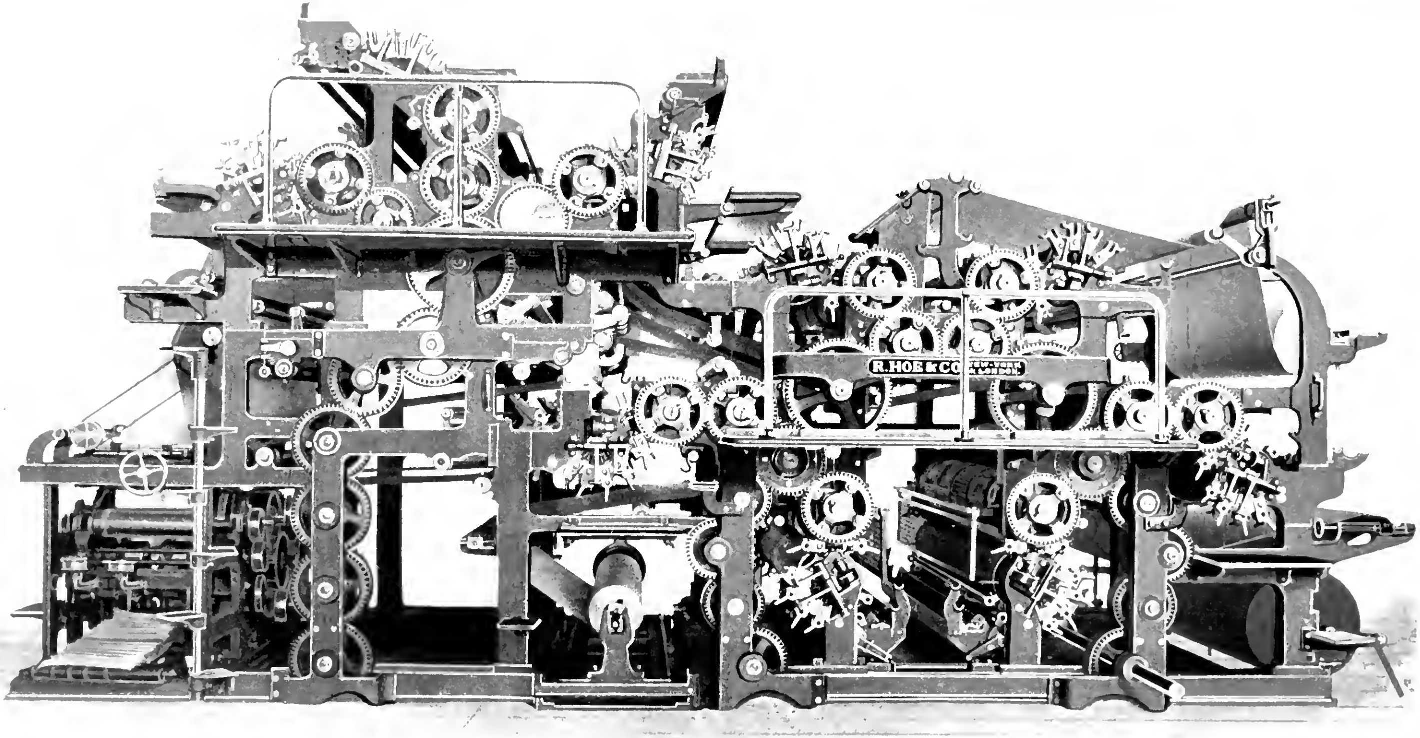
(We are indebted to the courtesy of R. Hoe & Co. for permission to reproduce this photograph. This picture and the succeeding one represent the most powerful and complete printing presses which have been constructed up to date.)

aim of all was to publish the general news of the day, but political influences were still strong enough to control editorial policy, and ultra-partisan and sectional views were incorporated in the record of events. There were still editors of great power and influence in politics and public affairs, and they tried to shape the current of the new condition by the force of editorial writing. A number of editors, of both the old and new order, for a time followed the policy of subordinating to partisan politics all other features of the newspaper. They sought to make the press the dominant influence in politics, and to do that they presented in their journals only one side of public and party questions. They undertook to think and to reason for their readers, and their partisan and sectional views were reflected in the news columns of their papers. So long as party feeling ran high this style of journalism was popular and successful, but the newspaper, being in the nature of an educator of the masses, soon set the people to thinking for themselves, and created a demand for the news of public and political events without the color of individual opinion. The change from intense partisanship to partial or complete independence of editorial utterance has come slowly, and is still under way. To-day there is no great daily newspaper in the United States so entirely subservient to a political party as to support any man or measure without question or protest. Politicians fear this spirit of independence, and therein lies the secret of the great power of the press in public affairs. The most powerful and successful journals are those that combine absolute fairness and honesty with independence.

So-called schools of journalism, in the rapid development of the profession during the past twenty years, have merged into one general system or plan, which is to get all the news and publish it. Journals may be graded or classified by their treatment of news and their judgment as to the intelligence and moral character of the reading public.

A detailed record of the development of the mechanical part of the newspaper business during the past thirty years would be almost a synopsis of all progress in science and art. The newspaper printing press of to-day, which prints, cuts, folds, and counts ninety-six thousand papers per hour, with one man to operate it, is the mechanical wonder of the age. It is justly regarded as the greatest piece of machinery that the ingenuity of man has yet devised. Type is no longer set by hand in the making of a newspaper, the letters being formed from the metal direct and cast in finished lines by machinery.

Studying the perfection and magnitude of the newspaper print-



SEXTUPLE STEREOTYPE PERFECTING PRESS AND FOLDERS (with color attachment for printing three additional colors on outside pages). It prints per hour 48,000 4-, 6-, 8-, 10-, or 12-page papers, 36,000 16 page papers, or 24,000 14-, 16-, 20 , or 24-page papers—all delivered folded, pasted, and counted. Also magazines with pages half the size of the newspaper pages, one half the pages printed in four colors and the other half in one color, at the rate of 48,000 of 8, 12, 16, 20, or 24 pages, and 24,000 of 28, 32, 40, or 48 pages, delivered folded to page size, cut open at the heads, bound with wire staples, and counted.

(We are indebted to the courtesy of R. Hoe & Co. for permission to reproduce this photograph.)

ing press of to-day it is difficult to realize that little more than half a century of time and invention stand between this piece of mechanism, that seems to work with human intelligence, and the Washington hand press, upon which the production of printed sheets was a matter of slow and arduous labor. The great metropolitan newspapers of to-day are printed by monster machines weighing thirty tons, composed of four thousand separate pieces of steel, iron, brass, wood, and cloth. In the great printing-press factory of R. Hoe & Co. eighteen months' time is required to build one of the modern presses, and the cost of it would have more than paid for all the newspaper printing presses in use in the United States at the beginning of the century. These monster machines are known as quadruple presses, which means that four complete presses have been built into one. When in operation, white paper is fed to them automatically from rolls, and this paper, with a speed greater than the eye can follow, is converted into the finished newspaper, printed on both sides, cut into sheets, pasted together, folded, counted, and deposited in files of fifty or one hundred at one side of the press. White paper is fed to the press from two points, and finished newspapers are delivered at two places on the opposite side. An idea of the speed with which the work is done may be gained by watching the printed papers fall from the folder. They drop so fast that the eye, no matter how well trained, can not count them. These presses have a capacity of ninety-six thousand four-, six-, or eight-page papers per hour, and forty-eight thousand ten-, twelve-, or sixteen-page papers. Their mechanism is so perfect and so carefully adjusted that the breaking of a narrow band of tape in the folder, the loosening of a nut, the slightest bending of a rod, friction in a bearing, or any other derangement, no matter how slight, is instantly apparent to the skilled machinist in charge.

The white paper used in making the newspapers of to-day is manufactured from wood pulp and is put up in long rolls, wound about an iron cylinder that can be adjusted in place at one end of the press. These rolls contain from two to four miles of paper, and weigh from eight hundred to twelve hundred pounds each. As soon as one roll is used up another is lifted into place, the loose ends of the two are pasted together, and, after a stop of less than two minutes, the great press is again belching forth finished newspapers at the rate of sixteen hundred a minute, or two hundred and sixty-six each second.

Almost every invention and device of recent years in connection with the use of electricity is in some way utilized in the production and distribution of the daily newspapers. The evolution

of journalism having finally established the fact that the chief function of the daily newspaper is to publish the news of the world, the problem of the business is how to obtain the news surely, accurately, and promptly. The ocean cable has taken the place of the sailing vessel, the trained correspondent has succeeded the occasional contributor, the electric telegraph and telephone have entirely superseded the mail in the transmission of domestic news, and every event of human interest throughout the civilized world is placed before millions of readers within a few hours of its actual occurrence.

The collection of news is not restricted by any question of the cost of obtaining it. Fifty years ago it was considered a remarkable feat for one newspaper to obtain information of an important event in advance of competitors. To-day it is a matter of comment if any newspaper fails to publish all the news desired by its readers. If a war is fought on any part of the earth there are reporters on the firing line, and no expense is spared in collecting and transmitting by the quickest method available full reports of any event of world-wide importance. To-day the hiring of special trains, the stringing of a special line of telegraph wire, the charter of a ship, the fitting out of an exploring expedition, or any other great enterprise in the way of collecting information for the newspapers of the United States, is so much a part of the everyday business of journalism that such things are accepted as a matter of course, or cause no more than a passing comment.

Half a century ago the result of a national convention or election was not known all over the country for weeks afterward. In the case of a national convention to-day, telegraph wires lead from the convention hall into the offices of all the newspapers in the larger cities. An operator sits near the platform of the presiding officer, and with a muffled key he sends over the wire a full report of the proceedings, with a description of every incident of interest. At the other end of the line is an operator at a type-casting machine receiving the report and putting it into lines as fast as received. When a candidate for President has been nominated, extra editions of the daily papers are selling on the streets of cities a thousand miles away almost before the applause for the winning man has died out in the convention hall. The people of every city and town in the United States where a newspaper is published would feel themselves cheated of their rights if they failed to receive news of the result of an election by midnight of the day on which the ballots were cast.

In enterprise and originality the journalism of America leads the world at the end of the nineteenth century. As a profession,

it commands, with alluring prospects of fame and fortune, the services of men of genius and learning. Those who enter it from choice succeed or fail quickly. It is a life of activity, a work where energy and intelligence are essential qualifications, and honor and honesty are certain of reward. There is no enduring place in the profession for hypocrisy, indolence, or mediocrity.

VALUE OF THE STUDY OF ART.

By GEORGES PERROT.

Georges Perrot is one of the leading art writers and teachers of France. Born in 1832, not far from Paris, he was graduated from the École Normale about 1855, and was then for three years at the French School at Athens. From his return to the present day he has occupied, with honor and distinction, many positions in the world of letters. At present he is a member of the Institut, an officer of the Légion d'Honneur, a professor à la Faculté des Lettres de Paris, and the director of the École Normale Supérieure. He is best known to scholars outside of France by the magnificent work on the History of Art in Antiquity, which he is writing, assisted by Charles Chipiez, architecte du gouvernement, and of which seven superb quartos have already appeared. (Hachette et Cie.) In 1891, by a decree of the Minister of Public Instruction, the study of the history of the fine arts was introduced into a section of the studies pursued at the lycées. In an article in the Revue des Deux Mondes, July 15, 1899, Perrot pleads for an increase of the time assigned to the study and for its introduction into other parts of the curriculum.

I have translated those pages of the article which are of general interest as a contribution to a subject which is deservedly attracting the attention of American institutions of learning. D. Cady Eaton.

Written and spoken language, the language of which the signs are words, is not the only language which man uses to convey his ideas. There is also the language of forms, which, with no less clearness and force, conveys the conceptions of the intellect and the sentiments of the heart. We study the history and the literature of bygone people for the purpose of acquiring a better knowledge of ourselves, and this knowledge is secured by becoming conscious of the different states of mind, to use a modern expression, through which our ancestors have passed. Even the most elementary and the most remote of these successive conditions are, unconsciously perhaps, represented in the depths of our being by beliefs and customs for which the present order and progress of civilization can not account.*

* The highest education consists in the presentation and in the acceptance of the purest ideas and the highest ideals of all ages, whether they be presented in written or spoken words, in songs of voices or sounds of instruments, in plastic forms or glowing pictures, in humble lives or glorious actions. The well-educated man should be the product and the epitome of the best thoughts and sentiments the world has produced, for he carries the responsibility of past centuries.

Not to go back to the Quaternary period or to the cave dwellers, there are many of these mental ideas or conditions which would remain hidden from the inquiry of the historian if he were limited to written testimony. One example may suffice: the discoveries of Schliemann, at Troy, Mycenæ, and Tiryns have rescued from oblivion a primitive Greece of which the Greeks themselves had preserved but a faint remembrance. Thus has been given to the Homeric epoch a background of many centuries. Now this Greece, contemporary of the Thutmoses and the Ramses of Egypt, anterior to not only Grecian history but even to Grecian tradition, could not write, but could work and use stone; could hew wood and fashion it for carpentry; could mold and bake clay; could melt and hammer lead, bronze, gold, and silver; and could carve ivory. Every bit of material fashioned by the instruments of this period has the value of an authentic document. How society was constituted, the life that was led, what notions were held of the hereafter—all these things are revealed by the marks the hands of man have left upon everything he touched. The colossal walls of Tiryns, the majestic funeral cupolas of Mycenæ, the divisions of the royal abodes of which the outlines can still be traced on the surface of the soil, and the arrangement of the sepulchres hidden beneath it all testify. So, too, the weapons, the instruments, the vases, and the jewels which have been found scattered about amid the ruins of the buildings or buried in the tombs. Thanks to all these monuments, we are beginning to recognize in a shadow which year by year glows with a brighter light the features which characterized the world of Achæan heroes of which the image, transformed by oral tradition and singularly enlarged by power of invention, is reflected in the Iliad and the Odyssey.

From these obscure and remote ages let us transport ourselves to the Greece of Pisistratus, of Pericles, and of Alexander. Instructors of youth tell of the losses which have been made, and of how small a part of the literary work of Greek genius has escaped the great shipwreck of antiquity. Should they not also indicate where precious supplements of information may be found to fill the voids of written tradition? There are many variations of important myths, hardly mentioned in passing by obscure epitomizers of the lower centuries, which have furnished to ceramic artists subjects for pictures which make us acquainted with personages and with episodes of which writers have hardly left a trace. But even if we had the works of the cyclic poets, all of which have perished; if we had the lyric poets, of whom only Pindar has survived, and Bacchylides whose fragments are to-day the joy of Hellenists; if we had the whole of tragedy, of which we have but the remnants;

if we had all of that comedy which is represented by Aristophanes alone; if we had all of the more ancient comedy, all of the middle period and all of the new, with Menander who since the Renaissance is the regret of all critics of fine apprehension—all this poetry could not exhaust the multiple fecundity and the prodigious richness of the imagination which created it. If malevolent Fortune had decreed the destruction of every bit of Greek plastic art we should have been condemned to perpetual ignorance of many aspects and methods of the Greek soul. Is there anything in literature worth the little clay figures of Tanagra in making clear how the Greeks apprehended and enjoyed female beauty: how they loved it not only in the noble and serious types of a Pallas or an Aphrodite, but even as presented by the humble inhabitants of little villages in the graceful *abandon* of their everyday life and in the liberty of their most ordinary attitudes? If we base an opinion of the religion of the Greeks only upon the epithets used by poets in defining the gods and upon actions they attributed to them, we run the risk of judging wrongly. In contemplating their images we obtain clearer notions of the ideas associated with each divine type. Alas! we do not possess the great works of Phidias which according to men of authority made men more religious—the Athene of the Parthenon and the Zeus of Olympia. But even in the reduced copies of these two masterpieces which have reached down to our time we can divine how the master expressed in the one the idea of calm and luminous intelligence and of supreme wisdom, and in the other the idea of that sovereign force in repose and of that omnipotence, tempered by goodness, which were conceived to exist in the sovereign of the universe, the father of gods and men.

In subsequent paragraphs Perrot imagines the Greek statues of the Louvre thus addressing a classical student:

"Young man, you who are studying Greece in Homer and Plato, in Sophocles and Herodotus, do not pass us by so quickly. We also belong to that Greece which you discern and which you seek in their writings, of which not without difficulty you decipher the prose and the verse. To understand and to love us, to read in our features the thoughts of which we are the expression, to seize in the modeling of our flesh and in the pure outline of our limbs the secret of the genius which created us, no grammar nor dictionary is needed; only apply yourself to the education of your eye. In this exercise, in this apprenticeship, you will find a pleasure which will become more and more keen as you become more capable of perceiving rapidly the finest gradations. If you aspire to become an authorized interpreter of Greek genius, do not fear that

you may be losing time. When, by long and affectionate intercourse, you shall have sufficiently entered into our intimacy to be able at any given hour to evoke in your spirit, as clearly as if we stood before you, a vision of the forms which shall have become dear to you, then the images which shall be awakened in your memories when you read the poets will be akin to those which the same recitals and the same epithets suggested to the Greeks who saw us born. To them you will be drawn by similarity of impression. You will be nearer to them, nearer to thinking and feeling after their fashion, at least by moments, than the most subtle grammarian or the most learned Hellenist who never has seen us."

Turning from Greece to Italy, Perrot derives a no less striking lesson from the statues of Roman emperors:

"Is there a lesson, though given by the most learned professor, that could cause to live before us all the life of the Rome of the Cæsars as do these effigies? In the long succession of portraits which embrace three centuries of history the differences of times and of men are contrasted more keenly and more vividly than in the recitals of ancient authors or in the dissertations of modern erudites. Augustus and Tiberius, Constantine and Theodosius, all bore the same title—'imperator'; all were called consuls, Cæsars, Augusti, *patres patriæ*, etc. Nevertheless, from the first to the fourth centuries the supreme power was greatly modified. Volumes have been written to explain the change, but there is nothing that makes it so clear as the comparison of the images of these princes. Augustus, in perhaps the most beautiful of all his statues, called *de Prima Porta*, has his head, arms, legs, and feet bare. Over the soldier's short tunic he wears a cuirass, and over it is thrown the military mantle of command. He is represented as supreme chief haranguing his troops. Another statue may represent him as a simple citizen, clothed with the toga and holding in his hand the manuscript of the discourse he proposes reading to the senate. The statues still show forth the Roman Republic, at least the customs and the style of it. Most vividly is the spirit and also the deception of the system perceived which, while investing a single individual with a power almost limitless, affects for two centuries a preservation of ancient liberties. Turn from these to an image of one of the successors of Diocletian, one who preferred to reside in Constantinople, the new capital of the empire. Do not seek his image in one of the ceremonial statues where, by force of routine, the sculptor may perchance have preserved classic rules; but in monuments of another order, where the artist kept closer to reality, in miniatures adorning manuscripts, in mosaics, in ivory diptychs, etc. There you will find figures which have nothing left

of the simplicity and nobility which Rome borrowed from Greece, but figures which in some particulars recall the old art of Asia, and in others already announce the art of the middle ages. The head is encircled with a diadem. The body and the limbs are entirely hidden by clinging draperies which are very long and very narrow. The materials which form this species of case are decorated from top to bottom with rich embroideries in the shape of medallions, flowers, animals, and even persons. There is no more deception; we are no longer in Rome; fictions so long preserved have finally disappeared; the empire has turned into an Oriental despotism.

"Between the two extremes of the series, how many degrees are there which furnish the very best commentaries of history? The heads of all the Cæsars, even those of Claudius, the accidental scholar, and of Caligula, the wicked and witty fool, are aristocratic. They show the nobility and the pride of race. You recognize in them the descendants of those grand patrician families which at first seemed to hold exclusively the right to give masters to the Romans. With Vespasian, scion of a middle-class family pushing its way into second-class public positions, the advent of a new order is evident. Vespasian has the round and smooth, double-chinned face of the chief clerk of a commercial or banking establishment. Trajan has the features of a soldier who has probably pushed his way to the front from the ranks. Hadrian, who turns his head to hear the better, whose bright eyes gleam even in the marble, whose half-opened mouth seems in the act of speech, shows the features of a learned and intelligent scholar. Marcus Aurelius, with his bristling hair and beard, would be taken for a Greek philosopher. In Caracalla's looks there is derangement. His eye betrays that murderous and fantastic frenzy which seized more than one emperor, especially of those who from early youth had been exposed to the temptations of absolute power.*

"Not to personages alone do pictured monuments give life.

* There is a bust of Julius Cæsar in England of which a cast or a copy should be by the side of every expounder of the Commentaries. The presence of the bust would give new life to the narrative, for there is more life in the marble than in the writing. There are in the Louvre, placed side by side, three representations of Nero which tell the story of the man more graphically than the pages of Suetonius. The first represents the youth, whose thoughts are pure, hopes bright, and resolves noble. The second shows the conflict with evil and the beginning of the triumph of sin. The third is so monstrous in its brutality and lust that it must have been taken but a short time before the catastrophe which terminated the matricide's career. Historians may detail the circumstances of the fall of Rome, philosophers may investigate the causes which led to it, but that hideous face in the Louvre tells the whole story with a force so startling, so instantaneous, that history and philosophy seem weak and wanting.

The same character of sensible reality is imparted to the frame and to the surroundings of the picture, to all the theater where these actors played their parts. Of this truth no one of our teachers, when I was a collegian, seemed to have a suspicion. There was not an illustration in the cold and dry compendiums which were placed in our hands. I can almost ask myself if, when I studied Greek and Roman history, I was really convinced that Sparta and Athens, Rome and Carthage had actually existed. I certainly did not know how or where to place them in space, what idea to have of their situation, or of the outlines made by the ridges of their walls, their houses, and their temples. All these cities were to me vague shadows, floating between heaven and earth. No one of them answered to a distinct and defined form.

"If this be the case with classical antiquity, in spite of the color and splendor of the narratives of its writers, how much more difficult is it to know and understand France of the middle ages when condemned to study it in its literary work alone! The literature of the period is partly in debased Latin, partly in early French. The French of the day was not the language of the thinkers. The deep thought of the age is not to be found in minstrelsy and ballads. It must be asked of the learned, of philosophers, of theologians, and of sacred writers. But to follow them in the subtle analyses and in the excessive complications of symbolism, in which they delight, requires mental efforts which are made all the more laborious by the artificial character of the church Latin, which no longer continued to renew itself at the source of popular speech. It is impossible to see how such works, in spite of their value to erudition, can be called to take part in the education of the young. It is for this reason that lately, by a judicious innovation, a discreet place has been made in the curriculum for histories and poems written in the common language, for the Chanson de Roland, and for the works of Villehardouin and Joinville. But the student can only read these in translations, or in those adaptations which so modernize the language as to leave but a little of its original flavor, and which therefore make but an imperfect contact between the original work and the mind of the reader. But supposing the scholar capable of mastering the original text: can its formless and superabundant prose, or the tiresome monotone of its flowing dissonances, give him emotions which have the vivacity of those which a page of Tacitus or a song of Virgil gives to those who know even a modicum of Latin? Can they have the power to excite the imagination in the same degree as any strong and concise sentence of the historian, any sonorous and glowing verse of the Roman poet?

"It is only exceptionally and as by flashes that the writings of the middle ages give the impression of true beauty. The conceptions are often grand, but the expression is always weak and dragging. On the other hand, Roman or Gothic churches are not less beautiful after their manner than Greek temples. Their beauty is of another fashion, but many souls are touched more deeply. They manifest no less clearly the power of the religious faith which constructed them. The particular character of Christian faith is shown with singular clearness in their majesty, in the elevation of their vaults, in the half lights which flood them, and in the thousands of figures which populate and animate every surface. As in Greece, the sculptor co-operates intelligently and docilely with the architect and has occupied no less happily the allotted fields. As Phidias and Alcamenes represented on the pediments and friezes of Doric temples the great gods of Greece and the local myths of Athens and Olympia, so anonymous masters, called to decorate the cathedrals of the middle ages, have placed impressive statues on the sides and in the *voussoirs* of the portals, in the open galleries which run along the façades, on the top of the pinnacles which throng the roof—in fact, everywhere where space is offered. These statues, distributed in an order regulated by doctrine and tradition, show forth the Saviour, the Virgin, saints and angels, prophets and apostles, and hosts of personages and scenes suggested by Holy Writ or by local and popular legends. Among these images there are many at Bourges, Chartres, Rheims, Amiens, and Nôtre Dame de Paris, which are marvels of severe elegance, of chaste and haughty grace, and of lofty moral nobility. This wonderful statuary has but lately been investigated, exposed, and studied, but already it would be difficult to find a connoisseur unwilling to compare with the most boasted statues of antiquity that admirable image of the teaching Christ of the west portal of Amiens, to which the popular surname has been attached of *le Beau Dieu d'Amiens*.

"For evident reasons, French sculpture of the thirteenth century did not, as did Greek sculpture, devote itself to the study and reproduction of the nude. It denied itself this attraction. All figures are clad; but beneath the drapery, which is in fine masses with large folds, the outline and the movement of form are indicated with precision. The principal interest and the rare originality, however, of this sculpture is that it is perhaps the most expressive that has ever existed. This expressiveness appears in the general effect of the pose, in the disposition of the drapery, but especially in the character which the artist has succeeded in giving to the features of the face.

"The august mysteries of the Christian dogma, the poetry of the Old and of the New Testament, the triumphant deaths of martyrs, the miracles of saints and their infinite charity—these things which the middle ages failed to put into clear and intelligible words are fully rendered in sculpture. The work of the chisel is large and firm. Difficulties are not sought, nor are they feared. Whatever be the material, the form is sure. To understand how superior the plastic is to the literary work, and to measure the distance, compare the Amiens statue with the portraits the authors of the Mysteries endeavor to draw of the Son of God. 'What can be more flat than these poor verses, which are nevertheless of the sixteenth century? The authors had good intentions and an apprehension of what should be done, but they were betrayed by the language in which they wrote. The sculptors of the thirteenth century, on the contrary, who possessed fully the grammar of their art, expressed all they felt, and have left us the most divine images of Jesus Christ in existence.' *

"Italy of the Renaissance is quite unintelligble to any one who has not measured the place held by art in the preoccupations not only of artists who practice it, but of all men of all conditions—of princes, nobles, tradesmen, and of citizens of most humble occupations. No one in any rank is without a passionate love for plastic beauty. This love was Italy's life and Italy's death. She died of it, because all her sap was consumed in satisfying it. It made her indifferent to her dismemberment, to the hard yoke of her tyrants, to the loss of her political liberties, and of her independence. But, at the same time, it constituted the intensity of her life which was exhausted and renewed again in the ardor with which she pursued her ideal and in her endeavors to realize it under all its aspects. Let him who would wish to obtain an exact idea of this condition reside for a while in Mantua, in Parma, in Sienna, in Florence, or in any other less-known city which nevertheless had its local school of art, its architects, its sculptors, its painters, some of whom, though they only worked for their native city, were not far from manifesting genius.†

"The written history of the seventeenth century and its rich literature can not alone give an idea of the situation occupied by Louis XIV in Europe when he was admired, imitated, or rather servilely copied, as pre-eminently the type of the modern king even by those who hated him the most. After two centuries, have we

* E. Mâle. Revue Universitaire, Third Année, l. i, p. 15.

† Raphael's Madonnas save the reputation of the papal see of the sixteenth century, for pontiffs who cherished such pure and gentle representations could not have been so corrupt as Luther's partisans assert.

not seen his wonderful prestige still potent in dominating the sickly mind of Louis II of Bavaria? In his desire to copy his chosen model Louis ruined himself in building palaces. In this folly he showed discrimination. Louis XIV, when dying, may have accused himself of having indulged too great a love for building; but his edifices, with their majestic grandeur and the opulence of their decoration, gave that royal life a frame which had much to do with the dazzling which all Europe experienced when in the presence of *le Roi Soleil*. In order to recognize and experience, though but for a moment, a little of the impression felt by all contemporaries, Versailles must be visited; the apartments of the palace, the terraces, and the alleys of the park must be traversed. Thus will be thrown upon this historic figure a light far more brilliant and true than could possibly be the result of learning by heart accounts of all the campaigns of Turenne or Condé, or all the clauses of the treaties of Nimègue and Ryswick.

"The same may be said of the eighteenth century, of which only an incomplete idea can be had without a knowledge of its art. This century, to which Voltaire gave the note, seems to have had no sentiment of poetry. Down to the time of André Chenier everything called poetry was no more than rhymed prose. The imagination, however, did not lose its rights. Like a stream which changes its bed, it withdrew from literature to flow into the arts of design. There it gives evidence of invention and of light and spontaneous grace. Architects adopt plans of happy arrangement. They employ forms of rare elegance both in the elements of construction and in the ornaments which decorate them. Such sculptors as Capperi and Houdon give to portraiture a marvelous intensity of life, while the terra cottas of Clodion, with their fantastic and voluptuous charm, recall the clay modelers of antiquity. Such painters as Greuze, Lancret, and Boucher spread before the eyes living idyls, while Watteau and Frangonard conjure dreams of ideal Cytheras, of a chimerical paradise where reign eternal youth and eternal desire. The politics of our kings and of our ministers of the period is but a succession of faults and weaknesses. The best concerted plans come to naught. The most brilliant victory produces no useful results. If France, in spite of so many reverses, still held her supremacy in Europe, she owed it to her writers and to her artists."

Perrot's arguments might be used with even greater force in reference to those notions which have had no Comines, no Joinville, no Froissart, no Villehardouin, but the history of whose civilization may be traced in monuments along the Rhine and the Danube, the Ems and the Elbe. In the last part of the article

Perrot considers the best methods of giving the desired instruction. However interesting and valuable his suggestions may be in communities where the instruction has already been established, it is evident that there must first be a conviction of the value and necessity of such studies and the determination to have them started. Methods are not difficult to devise, and will vary with national and individual tastes. That American colleges of thirty, forty, or fifty years ago should have objected to the introduction of the history of the fine arts into their curricula is easily understood. Art in any form was regarded by the New England mind as an emanation of the devil, and the New England mind controlled American colleges. Why the repugnance continues to exist is harder to understand. It may subsist from ignorance, from prejudice, or from conservatism. Conservatism may still regard all information to be derived from art as objectionable. Prejudice may still be strongly fixed in the notion that written and spoken words are the only vehicles of instruction, and that the arts are useless and idle vanities, while ignorance may be awaiting demonstration which will have to be strong and conclusive to awake it from self-satisfied apathy. May the good words of Perrot help on the cause and accelerate the time when the best and the fullest education will be offered by the American university!

HOW STANDARD TIME IS OBTAINED.

By T. B. WILLSON, M. A.

ALMOST everybody knows that observatories are the places from which standard time is sent out and corrected daily or hourly. But comparatively few have more than the vaguest idea of the means used at the observatories for obtaining it.

Probably the majority of people suppose that the observatories obtain the correct time from the sun. When the average man wishes to give his watch the highest praise he says, "It regulates the sun," not being aware that a watch which would keep with the sun around the year would have to be nearly as bad as Sam Weller's. The farmer may safely decide when to go in to dinner by the sun, but if the mariner was as confident that the sun marked always the correct time as the farmer is he would be sure to be at times two or three hundred miles from where he thought he was. In other words, the sun—that is, a sundial—is only correct on a few days in each year, and during the intervening times gets as far as a whole quarter hour fast or slow.

These variations of the sun from uniform time caused no end of trouble between the astronomers and the fine clockmakers before it was discovered that sun time is subject to such irregularities. The better the clock, the worse it often seemed to go.

But as the variations in sun time are now accurately known, correct time might be obtained from the sun by making proper allowance, were it not for the difficulty of observing its position with sufficient exactness. The large disk of the sun can not be located so perfectly as can the single point which a star makes. For this reason astronomers depend almost wholly upon the stars for obtaining accurate time. It is the method of doing this which we propose to describe.

There are several hundred stars whose positions have been established with the greatest accuracy by the most careful observations at a number of the principal observatories of the world. If a star's exact position is known, it can readily be calculated when it will pass the meridian of any given place—that is, the instant it will cross a north-and-south line through the place. The data regarding these stars are all published in the nautical almanacs, which are got out by several different observatories for the use of navigators and all others who have uses for them. These stars are known as "clock stars."

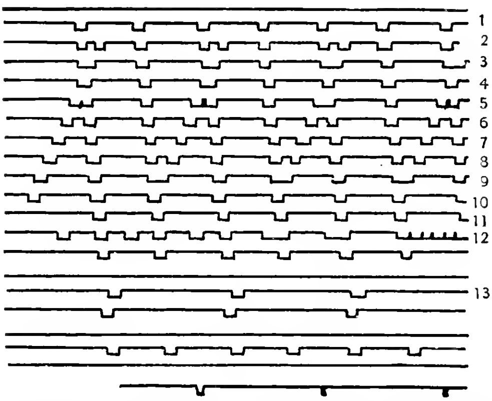
Every observatory is provided with at least one, or, better, several clocks that are very accurate indeed. Every appliance and precaution which science can suggest is resorted to to make these clocks accurate. The workmanship is, of course, very fine. What is known as the "retaining click" prevents their losing a single beat while being wound. The small variations in the length of the pendulum which changes of temperature would cause are offset by compensation. The rise of the mercury in the pendulum bob, if the weather grows warmer, shortens the pendulum precisely as much as the expansion of its rod lengthens it, and conversely if it becomes colder. Such clocks, too, are set on stone piers built up from below the surface of the ground and wholly independent of the building itself. Often the clocks are made with air-tight cases, and sometimes are placed in tightly closed chambers, only to be entered when absolutely necessary. Some fine clocks even have appliances for offsetting barometric changes, but these affect such clocks less than other influences or imperfections which can not be accounted for, and thus they are seldom provided against.

The astronomer's principal clock—the one he uses in all his calculations—marks what is known as sidereal, not ordinary, time. The revolution of the earth in its orbit sets the sun back in its

place in the heavens at the rate of about four minutes a day, or one whole day in a year, so that this clock, indicating star time, gains this amount and is only with ordinary clocks once a year. After it is once adjusted, no attempt is made to regulate it exactly, as the astronomer would better calculate its differences than disturb its regulation, always provided its rate is very uniform and accurately known.

One or more of the other clocks, however, are made to show ordinary time, and corrected by observations taken every few days. It is from this clock that the standard time is sent out.

It is possible to connect any of these clocks telegraphically with an instrument in the observatory, known as a chronograph. It consists of a cylinder with a sheet of paper around it, on which



A Short Section from the Paper Band of the Chronograph Cylinder, showing Tracings of Pen connected with Clocks: 1, seconds of sidereal clock; 2, both sidereal and common clocks; 3–10, the tracings of the mean-time clock fall steadily behind the other; 11, sidereal only; 12, connected with observer's key. The extra teeth show when a star passed each of the five spider lines. At the extreme right is a "rattle," put in to show where the observation is on the cylinder.

rests a pen connected with the telegraphic instrument which follows the beats of the clock. The cylinder is turned slowly by clockwork, and the pen, carried slowly along by a screw, describes a spiral on the paper with jogs or teeth in it about a quarter of an inch apart, caused by the beats of the clock. In this way the astronomer secures a visible record of the beating of his clock, or rather of the movements of his telegraphic recorder. Thus, if he has another key on the same circuit with the clock, connected with his chronograph recorder, and should touch it between the beats of his clock, it would put in an extra jog or tooth on his record, and it will show, what he could not have told in any other way, in just what part of the second he touched this key, whether in the first or last part of the second, and precisely how far from

either end—that is, he can determine fractions of a second with great nicety.

As a matter of fact, he has such a key at the telescope which he uses to make his observations in taking time, so that when he wishes to record the precise instant in which anything takes place which he is viewing through his telescope he has but to press the key in his hand and an extra tooth will be put into the record which the clock is making, somewhere among the regular teeth put in by the beating of the clock. Later, when he takes out the sheet he can see just where the tooth came, and so at what instant it was. If, now, he knows exactly what the instant was according to the true time as given in his almanacs—that is, what his clock ought to have shown at that instant—he can tell how nearly right his clock is. Once knowing how this clock is, it is a simple calculation to find how the clock which sends the signals is running, and to alter it if needed in a manner we shall describe later.

The observations the astronomer makes use of to determine these instants of time are upon the "clock stars." He uses a rather small telescope, known as a transit. It is placed with the nicest accuracy in a north-and-south line. It can turn over vertically, but can not move sideways out of its line. Its alignment is kept perfect by occasionally sighting some small mark a few rods from the observatory, either north or south.

If the astronomer points this transit, say, halfway up the southern heavens and sees a star pass across the center of its field he knows that that instant gives, as it were, the "noon mark" of that star. If it is one of the "clock stars," he knows by his tables what that instant of time is—should be—by his clock.

We have seen what his means are of comparing his clock and his observations. But observe, now, how much pains he takes to get the most exact observations.

To begin with, he must have calculated to a nicety his location. The director of an observatory always knows where he is located in a sense that few other men do. The accuracy of a large part of his observations of any kind depends on his first having determined the latitude and longitude of his observatory within a very few feet. Then the data given by his tables are all modified, and adapted to conform to his locality.

There are stretched across in the eyepiece of his transit five spider lines. The central one is on the central line of the field of his instrument. In observing a star for time the astronomer watches it as it is carried by the rotation of the earth past each of these spider lines, and presses his key—that is, makes a record—as it crosses each line. Taking the average of these five ob-

servations, he makes the possible error very small. But, in addition to this, he also usually makes observations on at least four clock stars, which gives him twenty observations to average up and determine by. As he inspects the record of these observations which has gone upon the chronograph sheet along with the clock beats he is able to determine, after proper calculations, how his clock stands.

Such observations are made every three or four evenings, and thus the clocks are not given time to get far out of the way. It is not usual for a good clock to show a variation of more than half a second. If the astronomer finds that his clock which is sending the time is running a fraction of a second slow, he goes to it and lays on the top of the pendulum bob a minute clipping of metal, which is equivalent to shortening the pendulum an infinitesimal amount. When he takes his next observation he discovers how his clock has been affected, and again treats it accordingly. Thus the time that is sent out automatically by the clock is kept always correct within a small fraction of a second. Those who receive the time sometimes arrange electro-magnets near the pendulums of their clocks, which act with the beats of the observatory clock, and their attraction is enough to hold or accelerate the pendulums as needed to make them synchronize with the observatory clock.

It will be seen that the means of obtaining exact time involve a very considerable outlay, and that the services of highly trained men are needed. The public is thus greatly indebted to the railroads, telephone companies, and other corporations which usually bear the expense of securing standard time. It is probable, however, that from motives of scientific pride no observatory would undertake to charge for this anything like what would be exacted for such rare service in any department of the commercial world.

It is worth while to note that even with such perfect clocks and favorable conditions it is still impossible to secure perfect timekeeping. Add to this the fact that it is not usual for those who send out the time, after it has been received from the observatory, to pay much heed to variations, even of several seconds, in their master clocks, and we see why it is a disheartening task to keep the best watch as near the second as the owner would fain have it. In the first place, the watch could hardly be made to keep such time if kept still in an unchanging temperature; secondly, it is still less capable of it when subjected to the jolting and changes of temperature it encounters when carried; and, thirdly, the means of obtaining time with sufficient exactitude are rarely available to the general public.

AGRICULTURAL EDUCATION IN FOREIGN COUNTRIES.

By W. E. DE RIEMER, M. A.

THE recent death, at the closing of the year 1898, of the lamented Senator Justin S. Morrill, who, as being the author of the Land-Grant College Act, is justly styled the father of agricultural education in the United States, seems to suggest the desirability of taking a survey of agricultural education as it at present exists in other countries than our own.

Since the pursuit of agriculture is one which concerns more of the people of our globe than any other pursuit, the necessity for scientific training for agriculturists becomes more and more evident to educated people. It is true that the cultivators of the soil do not generally admit the need of special schooling. At the beginning of this century very few educators, even, thought so. It was supposed that tilling the soil had nothing to do with schools, and that science had no connection with plowing and sowing. Agricultural lectureships were established early in the eighteenth century in several European universities, but they were regarded as curiosities of the age—superfluities of culture, rather than aids to the cultivator. Farmers themselves were supposed to be the only competent teachers of agriculture, and experience the only possible guide. But it has become apparent that no farmer's experience is broad enough to be adapted to all soils and climates. The successful farmer has come to regard the land which he owns as a wonderful machine which, if rightly managed, will turn out the most costly and perfect product; but which, if neglected or ignorantly handled, will disappoint his high hopes and possibly impoverish its owner. The development of commerce which so easily introduces the wheat and potatoes and other products of our country into competition with the grain produced in a distant land has taught the producers of this generation, and especially the citizen of European countries, that the farmer who can produce the largest crop of grain from the fewest acres, at the lowest price for the best cereal or vegetable, is the only successful cultivator. The nation which succeeds best in this direction with all its soil products is the one which is sure to have the "balance of trade" always in its favor.

The United States awoke to this idea when, in 1862, Congress passed the Land-Grant College Act, allotting Government lands in every State to aid in founding agricultural colleges. The country became more profoundly moved by this idea when, in 1887, Congress passed the Hatch Act, granting annually to each State the sum of fifteen thousand dollars to organize and perpetuate agri-

cultural experiment stations, and still further when it organized a Department of Experiment Stations as an integral part of the Department of Agriculture.

But several of the countries of Europe have anticipated our action in behalf of agricultural education by a quarter of a century. Germany and France and little Switzerland realized fifty years ago that agriculture in its various departments must be pursued with the aid of the latest science combined with the broadest experience. These countries have not waited for the laborer to perfect himself in experience—an impossible attainment—but they have opened schools of every possible grade, arranged courses of lectures by the best educated scientists, made elementary agriculture a compulsory subject in the curricula of the common schools, sent out traveling instructors to confer with and advise and give courses of lectures to the older farmers, made it possible—even compulsory—that young people should attend technical schools at odd hours of the day or evening, and even tempted them to pass a serious examination in their respective studies by the offer of a valuable prize as the reward of success. It is said that Charles Dickens once made a speech at an agricultural dinner in which he somewhat derisively said that "the field it paid the farmer best to cultivate was the one within the ring fence of his own skull." Dickens was correct. The farmer needs scientific education. The best civilized and progressive nations of to-day are admitting the utterance of Dickens to be a serious truth. Vast sums of money are appropriated by European governments to prevent their agricultural classes from continuing in or subsiding into ignorance of their art. Even the peasants of Russia, notably in the province of Ekaterinoslav, by the generous appliances for special agricultural education made by the Ministry of Agriculture and State Domains, united with the efforts of the Ministry of Public Instruction, are made to feel that without expert teaching a man can not succeed even in the raising of fowls or of bees, the culture of silkworms, the making of wine, or the manuring of his fields. Consul Heenan * says that in the province named above the Government annually rents thirty-two experiment fields, each eight acres in extent, distributed four in each district, and each one located in the midst of peasant fields. Each of these fields is placed in charge of some scientifically educated public-school teacher, who is paid twenty-five dollars per year for his direction, and receives, besides, all the harvest produced. The teacher uses the native tools and seeds, and hires neighbor peasants to assist in demonstrating that with care in plowing, cleaning of seed, cultivating,

* See United States Consular Reports, vol. lvii, No. 215, August, 1898, article on Gardener's Schools in Russia, by Consul Heenan.

and reaping, his field will produce larger crops than his slovenly or ignorant neighbor. The object lesson has its certain result. The peasants are gradually adopting the four-field culture system—viz., fallow, winter crops, pastures, and summer crops.

Besides these, Russia sustains 68 agricultural schools, containing 3,157 pupils, at a cost of $403,500, of which sum the Government pays $277,500, and the local *zemstovs* (societies) or the school founders pay $136,000.

In France the eminent scientist Lavoisier, at the close of the last century, advocated the founding of a national school for the teaching of agricultural science. His plan for government initiation was not realized, but in 1822 Matthieu de Dombasle founded, near Nancy, the first true agricultural school. In 1829 and 1830 the schools at Grignon and Grandjouan were founded by August Bella and Riefell respectively. Now France boasts of one of the most perfect systems of agricultural education of any country of the world. Under the joint direction of her Ministers of Agriculture and of Public Instruction, France plans to cover every phase of education from the simplest forms of object lessons taught by law in all her primary schools to the crowning National Institute of Agriculture at Paris. The facts of science, united with the soundest experience, are demonstrated to the farmer by lectures and experimentation; the future agriculturists of the country are educated in the certainties of scientific research at graded schools, ranging from elementary to university degrees, and every milkmaid is taught the necessity of promptness, cleanliness, and system in the care of milch cows and in the disposal of their milk.

The former able Director-General of French Agriculture, Monsieur Tisserand, says: "The aim and object of France has been not only to give to children and young people the means of acquiring knowledge, but also to establish means for *interesting old cultivators.* In this century of extreme competition we must admit that the agriculturist can only thrive if, in working the soil, he adopts scientific methods. Old routine is no longer sufficient in this branch, as it is proved to be insufficient in manufacture." In carrying out her enlightened policy, instruction was given in 1893 * to 3,600 pupil teachers. Thirty agricultural laboratories throughout the country furnish analyses of soils and manures for the help of cultivators, and 3,362 trial fields are established where farmers can profit by experiments suitable to their own districts. The special farm schools number sixteen; practical schools of agriculture, thirty-nine; national schools of agriculture and horticulture,

* Statistics of 1893. The French Government only occasionally issues its official report of agricultural schools.

six; three veterinary schools; and one each, bearing the name of National Agronomic Institute, is a shepherd school, a cheese, and a silkworm school. In the universities are no less than 160 departments and chairs of agriculture for students of profoundest research. All this costs the departments alone over 4,504,050 francs per annum.

In Prussian Germany no less activity is displayed or energy put forth to make the farmer's occupation one of financial profit and scientific status. Statistics for 1897 are at hand in the report of the Prussian Minister of Agriculture. The German system is based on the theory that schools and colleges are the only places where theoretical agriculture can be properly taught. Few of the higher agricultural schools first established were exclusively such. A liberal education could be obtained at most of them without touching the subject of agriculture. Later educators have developed a system which begins by fostering a love for Nature in the minds of the pupils in the kindergarten, and patiently develops that love through all the dozen or more grades of schools until it culminates in the polytechnic school or the degree granted by the university.

Germany is indebted to the learned Professor Thaer for the establishment of its first agricultural school at Möglin in 1807. But more than all is she, in common with all the world, indebted to the famous chemist Baron von Liebig, who, in 1840, announced the scientific truth which underlies all arguments for agricultural education—viz., that no matter how impoverished a soil is naturally, or has become by excessive cropping, its fertility may be restored, maintained, and even increased by providing it with the mineral and organic matter which it lacks.

Prussian agricultural affairs are under the supervision of the Ministry of Agriculture, Domains, and Forests. The state maintains three grades of schools—higher, middle, and lower—as in other European countries. The most celebrated are the Royal Agricultural High Schools at Berlin and Popplesdorf, two royal academies of forestry, and the university courses in agriculture at Halle, Göttingen, Königsberg, Leipsic, Giessen, and Jena. The state expends something like two hundred thousand dollars annually on agricultural education. In Germany agricultural education has so broadened out as to include training in every technical part of a farmer's work—culture of forests, fruits, flowers, and vines; schools to teach wine, cider, and beer making, machine repairing, engine running, barn construction, and surveying; knowledge of poultry, bees, and silkworm raising; domestic economy, sewing, and accounts for farm women—all in addition to the long scientific

courses of study and years of practical work on an established farm. Verily, the country that excels Germany in training agriculturists must be *par excellence* in its methods.

A special feature of agricultural teaching is the traveling professor (*Wanderlehrer*). United States Consul Monaghan enthusiastically describes him: "These teachers, supported partly by the state and by agricultural unions, go from place to place . . . and lecture on agricultural and horticultural subjects. Their purpose is to lift up and ennoble agricultural life; to afford the farmer the knowledge gleaned by science since he left the school; to impart to him the best methods of selecting soils, fertilizers, cattle, trees, etc.; to teach him how to use his lands to best advantage, to graft, to breed in; to get the best, quickest, and most profitable results. These teachers are skilled scientists, practical workers, not theorists, . . . perfectly familiar with the wants and needs of their districts. Armed with this knowledge, the teacher's usefulness is certain and unlimited. When he speaks his voice is that of one in authority, it is heeded. . . . He is a walking encyclopædia of knowledge, especially of knowledge pertaining to the woods, hills, farms, and fields."

Austria has, like Germany, a system of agricultural and forestry schools in three grades—viz., superior, middle, and lower. Its oldest school of superior grade was established in 1799 at Krumman.* Similar schools existed later at Grätz, Trieste, Lemberg, Trutsch, and Altenburg. The latter is especially complete in every appliance for instruction, and well patronized. The middle schools provide two-year courses of study and practice, and are located at Grossan, Kreutz, Dublany, and other points, while the lower schools incline less to study and more to lectures and farm practice. They are located in the provinces of Bohemia, Styria, Galicia, and Carinthia.

Forestry schools of various grades exist at Mariabrunn, Wissewasser, Aussen, Pibram, Windschact, and Nagny; of these, Mariabrunn is especially deserving of mention for its thorough course and complete equipment.

Switzerland was the home of the philanthropist and educator Fellenburg. His school, established at Hopyl in 1806, was a philanthropy in aid of the peasantry, concerning whom he said that possessing nothing but bodies and minds, the cultivation of these was the only antidote for their poverty. At least three thousand pupils received their education in agriculture here. The Federal Polytechnic School at Zurich is the nation's pride. Out of six courses of superior training which it provides for its one thousand

* See Barnard's Journal of Education, vol. xx, 1870, p. 673.

students, forestry and agriculture count as two. Five universities and numerous special schools furnish aid to agricultural education.

The little kingdoms of Belgium and Holland are following hard upon the tracks of their powerful neighbors. In Belgium may be found superior institutions of agriculture, horticulture, veterinary science, and forestry at Gembloux, Vilvorde, Cureghem, and Bouillon respectively.

In Holland, whose people robbed the sea to obtain lands for farms and homes, about £71,500 were expended by the state on its agricultural department in 1897. Its first school, established by a communal society at Hären in 1842, was discontinued. The state in 1876 adopted the school of agriculture which has been established at Wageningen as its own, and this institution can fairly lay claim to equality with any in Europe. Government also supports the State Veterinary College at Utrecht, and subsidizes a school of forestry and several dairy schools. Agricultural teaching in primary schools has not yet proved a success.

Italy has not made such progress in agricultural education as her northern neighbors, yet she is not indifferent to the requirements of the times. She has a most unique scheme for Government superintendence of agricultural matters. All comes under the purview of a general Director of Agriculture, assisted by a Council for Agricultural Instruction, which latter was established by royal decree in 1885, and reorganized in 1887. Four divisions of the department exist—namely, (1) agriculture proper, (2) zoötechny, (3) forestry, and (4) agricultural hydraulics. Statistics are not easily procured, but recent catalogues show that the two Royal Superior Schools of Agriculture, located respectively at Milan and Portici, are institutions of which any country might be proud. Of the latter Mr. E. Neville Rolfe, British consul, wrote in 1897 that it was originally a provincial establishment, but in 1885 it had been established by royal charter and domiciled in the magnificent grounds and buildings of a disused royal palace. Its study course requires three years to complete, and graduates obtain the degree of Laureato Agronomo. Up to 1896, two hundred and twenty-eight students had obtained this degree, most of whom are instructors or Government employees of high rank. It is known also that thirty-three special and practical agricultural schools exist in different parts of the kingdom.

Much can not be said in praise of agricultural education in Spain. That country possesses the machinery for education of the higher grades, but through her seven distinctly agricultural colleges, located at Madrid, Saragossa, Barcelona, Corunna, Valencia, Caceres, and Jerez, she seems only to have obtained men for Gov-

ernment service at home or abroad. Spain expended in 1896 on agricultural education the sum of £58,460, but she evidently sends no *Wanderlehrer* instructors among her peasant farmers.

It is said that Portugal possesses seven agricultural schools, attended in 1896 by one hundred and eighty-seven students, but of their location, save one, and courses of study the writer has no information. The Government conduct of education is committed to a Director-General of Agriculture. The leading school is named the General Institute of Agriculture, and is located at Lisbon. It provides four courses—viz., (1) rural engineering, (2) agronomy, (3) sylviculture, (4) veterinary medicine. It has a large tract of land for demonstration purposes located a few miles from the city.

Concerning Greece and the smaller kingdoms in southeastern Europe, together with the land of the Turk, not much to the encouragement of the scientific agriculturist can be said; but turning northward across Europe to the Scandinavian countries quite a different state of things becomes apparent. At once we find that the system of agricultural education is highly developed, and in some phases is not surpassed by other countries. Immediately we are in a network of dairy schools, experiment stations, chemical and seed-control stations, agricultural societies, colleges, and universities. Here we find five institutions all under royal patronage and state support. In Norway is the Higher Agricultural School at Aas, established in 1859. In Sweden stands the Agricultural Institute at Ultuna, established in 1849, and the Alnarp Agricultural and Dairy Institute, established in 1862. In Denmark is the Royal Veterinary and Agricultural College at Copenhagen, established in 1773 as a veterinary college. In Finland the Mustiala Agricultural and Dairy Institute, established in 1840. In these four small states there exist agricultural, horticultural, forestry, and dairy schools of all grades to the number of one hundred and fifty-nine. Education in agriculture is not attempted in the primary public schools of Norway or in any of these Scandinavian countries, but agricultural elementary instruction is begun in what other continental countries would call secondary schools, and is provided for persons intending to be farmers and who are eighteen years of age and older. Norway spent on elementary agricultural education in secondary schools, in 1895–'96, the sum of $31,182, and Finland more than doubled that sum.

Crossing the Channel to Great Britain, again we see a nation intent on solving the question of success for her agricultural population. Celebrated Englishmen, Scotchmen, and Irishmen early began to plan for an educated peasantry, but it was long before any national system was evolved. The sectional divisions and peculiari-

ties belonging severally to Scot and Celt and Saxon have not yet permitted a uniform legislation. Ireland and Scotland each has its own scheme of Government supervision, and both differ from England and Wales. It is estimated that but ten per cent of England's laboring population is concerned with agriculture for support, while in Ireland there is scarcely ten per cent of the people who are not dependent on agriculture for existence. In consequence, we find in Ireland, as in France, intense interest centers upon the plan to teach agriculture and horticulture in the elementary public schools, while in England, until very recently, agricultural education served principally to produce a class of educated scientific men fitted for the Government home and colonial service.

In Ireland compulsory attendance on primary schools is made by law. In 1876 Ireland claimed to be the pioneer country in providing compulsory elementary agricultural instruction in all her rural schools. She has desperately clung to the theory that in providing such education in her elementary schools she would eventually train a nation of agriculturists. To attain this end, elementary text-books were prepared, which all teachers must use. The Government grant for a pass at examination in agriculture was much larger than a pass in any other study; teachers who held certificates to teach it were given higher salaries than others, and to enable teachers to prepare for such certificates, scholarships were offered them at teachers' colleges (normal schools), and their railway fare was free in going and coming. Plots of ground at schoolhouse or teacher's house were provided, where flower and vegetable culture could be constantly practiced, and a special grant was allowed to the school for cultivating a successful garden, and another special for classes showing proficiency in practical work. Gardens were cultivated at convents and workhouses, and the subject was taught theoretically to "half-time" pupils and students at the "evening continuation schools."

In December, 1896, Ireland had 8,606 national schools, with an average attendance of 815,248 pupils. She also had 150 half-time schools, 155 workhouse schools, 267 convent schools, 30 model schools, five training colleges for teachers, and two training agricultural institutes (at Glassnevin and at Munster), and in all of these agricultural science or practice is either a compulsory or a voluntary subject. What country can surpass Ireland's enthusiasm for agricultural training? *

* A bill for the development of Irish agricultural industry and Irish technical education, providing for Government aid to private enterprise in agriculture, and in manufacturing industries also, has just passed (August, 1899) the House of Commons, and is assured its passage by the House of Lords also.

Scotland enjoys deservedly the distinction of having been first among the peoples of Europe to introduce in the university course scientific education in agriculture. In 1790 a chair was established in the University of Edinburgh, and a course of agricultural lectures was given therefrom by Rev. D. Walker. Better than that, in 1743 a volume entitled Select Transactions was published by Maxwell, representing the agricultural society known as the "Society of Improvers," and numbering at one time three hundred members. Out of this society grew the "Highland and Agricultural Society," which organization has fostered every agricultural effort which private beneficence or royal grant has initiated in the land since 1834. Through its munificence both the departments of forestry and veterinary surgery have been placed upon a firm educational basis, and the educational lectureship of Edinburgh University has been permanently endowed. It has instituted its own syllabus of examinations for granting "Fellowships in Agriculture," and stimulated pupils of the secondary schools to make the effort by offering prizes and scholarships to the ambitious students.

The University of Aberdeen has lately entered the field as an agricultural educator by becoming what the Government styles a "collegiate center," receiving a straight subsidy of £100 per annum, and furnishing professional instructors to rural assemblies arranging lectures for them. In the public schools of Scotland agricultural science is arranged for as an optional study from the third to the sixth standards inclusive. In 1895–'96, 4,148 pupils passed examinations in the subject, and the cost of this to the state was £42,792. In 1896–'97 pupils in the "evening continuation schools" to the number of 1,089 passed in agriculture, and 115 others in horticulture.

England and Wales are under a joint administration of agricultural affairs. The Government policy, so far as it has one, has been continually opposed to paternalism and direct subsidy or ownership of schools. Rather has her Parliament waited to be solicited to make subventions by way of encouraging individual or local society initiative. The flourishing agricultural schools at Cirencester and Downton, for the instruction of the higher classes, have grown out of private establishments, then been perpetuated by obtaining royal charters, by which the Government became pledged to supply any lack of income. But since 1893 the state has so far relaxed her policy as to grant subsidies to certain colleges centrally located, which it styles "collegiate centers," through which colleges it offers superior instruction to the public. These colleges associate with themselves ample farm lands for experiment grounds and dairy machinery, and equip themselves with competent lec-

turers, who are also practical experts, and who, upon invitation from agricultural societies or county councils, go forth as lecturers upon their special subjects. Each adjacent county makes an annual grant of £75 to the college funds, and is privileged to nominate students to attend the college agricultural course at a reduction of twenty-five per cent on the usual fee. In 1898–'99 the Board of Education granted to fifteen colleges and associations in England and Wales the sum of £7,200. The colleges were the Yorkshire College at Leeds, Durham College of Science at Newcastle-on-Tyne, University Extension College at Reading, University College at Nottingham, Southeastern Agricultural College at Wye, and in Wales the University Colleges at Bangor and Aberystwith.

Besides the direct Government subsidy to higher education, the state grants to the several counties part of the money raised from the excise ("drink money") for educational purposes, out of which at least £78,000 were spent by the committees in 1896–'97 in promoting agricultural education.

Still further, Parliament puts into the hands of the Science and Art Department large sums of money to be expended as grants-in-aid of "technical education." The state recognizes instruction in the principles of agriculture as instruction in elementary science, and through this Science and Art Department's grants to primary and secondary schools, and to teachers' colleges, it encourages agricultural education as a technical study. In 1896–'97, 1,023 pupils passed examination, and the respective school managements received as grant on their account a total sum of £140,150.*

In 1897 the Royal Commission on Agricultural Depression in England made its report. Among other declarations made by the commission were these: "We believe that it is essential for the welfare of agriculture that there should be placed within the reach of every young farmer a sound, general school education, including such a grounding in the elements of sciences bearing upon agriculture—e. g., chemistry, geology, botany, and animal physiology—as will give him an intelligent interest in them and familiarize him in their language." †

They further recommend that hereafter the control of all funds for technical agricultural education be placed with the Board of Agriculture, and that the entire income of the Customs and Excise Act of 1890 should be devoted to educational purposes, agriculture receiving its adequate share. Should the first recommendation carry for all divisions of the United Kingdom, agriculture would

* Appendix to Report of Science and Art Department, 1896–'97.

† Page 152 of Report.

cease to be one of the subjects provided for examination by the Science and Art Department. Should the second recommendation become a law, the sum expended by local county councils in agricultural education would be vastly increased.

Passing from England to her colonies, let us journey toward the sunrising. Stopping for a moment in Egypt, we note with pleasure the existence of the newly established School of Agriculture at Gizeh, which is under the direction of the Ministry of Public Instruction for Egypt. Its reconstructed course of study was open to students in 1898, and it provides for four years of study. Arabic and English are the teaching languages, especially the latter, and allotments of land for individual culture are made to all pupils.

Beyond the Indian Ocean lies Hindustan. Here all science study is awaiting its development. The best cultivation of India is not behind that of England as a matter of empiricism,* but the science of cultivation is yet to be developed. Agricultural chemistry and agricultural botany and horticulture, as related to India, have scarcely been investigated, and text-books in the native tongues have yet to be written. For this accomplishment all elementary instruction in public schools must patiently wait. For an agriculturally educated set of teachers, also, Indian youth studying in the vernacular must patiently wait. In 1889 the home Government (Parliament) laid upon the Indian Educational Department the duty of providing school "readers" which should contain elementary instruction in agricultural science, and it authorized a liberal grant-in-aid toward such schools as could furnish pupils for passes in this subject. For those students who have mastered the English language a few colleges exist. Saidapet, near Madras, with about forty students in a three-years' course, including veterinary, is a pure agricultural institution. Fourteen students received diplomas in agriculture in March, 1897.

Several colleges have agricultural departments, notably the Poona College of Science in the Bombay presidency; the Baroda College; the Maharajah's College and the Shimoga College, Mysore; the Central College, and the Sanskrit College of Bangalore. All of these are affiliated with the University of Bombay, and

* Dr. Voelker, in his Report on Improvement of Indian Agriculture, made to the English Board of Agriculture in 1893, said: "At the best, the Indian *raiyat*, or cultivator, is quite as good as, and in some respects the superior of, the average British farmer. It is wonderful, too, how much is known of rotation, the system of mixed crops, and of fallowing. Certain it is that I, at least, have never seen a more perfect picture of careful cultivation, combined with hard labor, perseverance, and fertility of resource, than I have seen at many of the halting places. Such are the gardens of Máhim, the fields of Nadiad, the center of the garden of Gujarat, in Bombay."

present pupils for examination in agriculture for the degree of B. Sc. A.

In many of the English high schools of India are found agricultural classes which give both science teaching and field practice. These schools are at Nagpur, Nasik, Sholapur, Ahmednagar, Ahmedabad, Dhulia, Kolapur, Surat, Belgaum, and Nadiad. The stimulus to study in these schools is the hope of obtaining a diploma in agriculture, which would result in employment in the Government service.

In Lucknow is a celebrated veterinary school whose graduates have been greatly sought after. One at Bombay has become still more celebrated. In 1897 sixty-nine students were in attendance. Graduates easily found employment with native rajahs, and on the island of Ceylon, and at Mozambique. Another Government veterinary school recently established at Belgatchia, Calcutta presidency, has done good work.

The forestry school at Dehra Dun, in the Northwest Provinces, has attained a great reputation. About seventy students attend, and the Government charges the cost of the school, 33,000 rupees, to the districts which send up pupils for study. India, under the British rule, will soon come into line with educated agriculturists.

In Burmah and in Assam steps have been taken to introduce science lessons into Government, or grant-in-aid, elementary schools by the preparation of "readers," as in India, but no secondary or superior schools in agriculture exist in these countries. So far as we know, the same is true of Siam and the Malayan Archipelago and of the Philippines.

Australia, as a federation of states, is late in its development, but some of its states are surprisingly advanced. New Zealand has its superior university, combining the three colleges at Auckland, Lincoln, and Otago. Its syllabus provides for searching examinations in agriculture to obtain the degree of B. Sc., either of these colleges having previously granted the diploma of agriculture to successful students. Each of these colleges has ample grants of land, but only one—the Canterbury College at Lincoln—has yet presented agricultural candidates. Forty-four graduates have received diplomas previous to 1895. Instruction in elementary schools seems not yet to have included agriculture.

In Queensland the Queensland Agricultural College was opened at Gatton in 1897.

In South Australia is an agricultural college at Roseworthy and another at Adelaide which has graduated several recipients of the diploma.

In Victoria there exists a college at Dookia and another at Longerong. There is also a school of horticulture at Richmond.

To New South Wales belongs the banner for furnishing the greatest opportunities for agricultural education. Its university at Sydney grants a degree of B. Sc. to students from the colleges of St. Paul, St. John, St. Andrew, the Woman's College, and the Sydney Grammar School. At Sydney also is the splendid Technical College, handsomely endowed, having an agricultural department. The superior of all other schools is the Hawksbury Agricultural College and Experimental Farm at Richmond, established in 1891, richly endowed with land (three thousand acres), and organized on the most approved modern models. Science teaching is not carried so high as the university standard, but all manner of practical work must be performed by each student.

Homeward bound, we reach Cape Colony, South Africa. Here, in 1887, the Government inaugurated a scheme for aiding farm schools in which elementary agriculture was taught. In 1894, out of 352 schools aided by the Government, 202 were classed as "farmhouse schools." In higher education there may be found (1898) the School of Agriculture and Viticulture at Stellenbosch, and a second one at Sunset East. As both of these schools are young, statistics concerning them are not yet available.

Last of England's colonies we notice the Dominion of Canada on our northern frontier. No evident progress has been made in introducing agricultural science teaching in the primary schools of the entire Dominion. The first step taken in the direction of agricultural education was for the enlightenment of farmers. In 1886 Parliament authorized the establishment of a system of experiment farms, one in each province in Canada, viz.: one at Ottawa (to serve both Quebec and Ontario), and one each at Nappan, in Nova Scotia; at Brandon, Manitoba; at Indian Head, Assiniboia; at Agassiz, British Columbia; and at Charlottetown, Prince Edward Island. To give these stations greater efficiency, the Government encouraged the formation of farmers' institutes in every electoral district for the hearing of lectures from experts which it provided, and for discussion or business. To each regularly organized institute of fifty members a grant of £10 is annually made.

In Nova Scotia five primary and secondary schools are reported as giving agricultural instruction to two hundred pupils. Some of these schools have farms or gardens. The Provincial School of Agriculture at Truro is making a good beginning. In its last class three students were granted teachers' diplomas, seven received farmers' diplomas, and eighteen took farmers' certificates. Three

hundred and fifty students have pursued its course of studies. There is also a horticultural school at Annapolis Valley.

Another horticultural school exists at Wolfville, Nova Scotia, under the control of a committee of the Fruit-Growers' Association. Students take a thorough course of two years' duration. The Legislatures of New Brunswick and of Prince Edward Island grant bonuses of fifty dollars to each young man of their provinces who will take a course at this school.

Fine creamery plants are found at various points, and several provinces sustain each a "traveling dairy," which systematically visits accessible centers and gives demonstration lectures to farmers' families.

The crowning agricultural educational institution for the entire Dominion is the college at Guelph, Ontario. It combines instruction in veterinary science, horticulture, bee and poultry keeping, dairying, and the experimental farm. The course continues for three years. Two years confers the "associate diploma," and three years' study, with successful examination in the syllabus of the Toronto University, secures the degree of B. Sc. A. Success attends all these educational efforts and marks this colonial empire as among the ranks representing true progress.

Mexico and the countries of South America next claim our notice. In the first-named country, as early as the year 1850 provision was made at the old college of San Gregorio for instruction in agriculture in five different courses. But in 1854 the Government came into possession of the disused convent of San Jacinto, Agosta. Here a national school was organized, combining the two departments of agriculture and veterinary science. It was opened February 22, 1854, and designated the National School of Agriculture and Veterinary Science. Its courses of study are up to the best standards. Three years are necessary to complete the agricultural course and receive the title of Superintendent of Rural Estates, and four years' study must be given to secure that of Ingeniero Agronomo. The course was readjusted in 1893. During the five years past 169 graduates have received the former and 68 the latter degrees. The management consists of 48 persons, whose salaries annually cost the Government 96,424 Mexican dollars. Ample grounds and buildings are provided to make this institution a matter for national pride.

Besides this college, a farm school exists in one of the federal districts, costing annually $17,564, and another at the colony of Porfirio Diaz, costing the state $14,708. Mexico is also moving to introduce agriculture as a subject for primary instruction in public schools.

In Uruguay exist fine schools for teaching agriculture and viticulture which are of recent organization. At Montevideo the Government has created a Department of Live Stock and Agriculture, subject to the Home Ministry. The budget of 1897 provides for organizing and sustaining agricultural schools and experiment farms to the extent of $28,222, with an additional allowance of $90,000 for experiments on farms, installation of plants, furniture, instruments, etc.

Chili is coming to the front in her educational efforts. In the city of Concepción exists a Practical School of Agriculture. Others are found at Santiago, at Talca, San Fernando, Elqui, and Salamanca. The school at Santiago receives an annual subvention of $40,000, and that at Concepción the sum of $23,000. Attached to the latter are agronomic stations for soil analysis and oversight of irrigation systems of the state. The Sociedad Nacional de Agricultur at Santiago receives an annual grant of $20,000, which it distributes at agricultural shows and for the support of the zoölogical garden. At Quintan Normal is also an Institute Agricola of high grade for agricultural engineers and agronomics, or for furnishing a simple certificate in agriculture.

Other countries of South America possess education facilities, but we are not supplied with details concerning them.

Our closing glance must be directed to the far Orient. Japan, the newest of kingdoms, has a model brace of institutions for superior education in agriculture. When Japan awoke to the new ideas, to which for ages she was oblivious, her keenest statesmen grasped the thought that her agricultural people needed new light and intellectual quickening along the lines which so vitally affected their daily subsistence. She took the United States into her confidence. She imported for a season our Commissioner of Agriculture (General Capron), in 1871–'72, as "Adviser to the Colonial Office at Hokaido," who, after visiting Japan, advised the Government to organize at once an agricultural college at Sapporo, and still another at Tokio. This advice was cordially received and speedily adopted. American scholars of the highest wisdom and experience were imported to inaugurate the work. The college was inaugurated by Colonel W. S. Clark, LL. D., President of Amherst Agricultural College, in August, 1876, with twenty-four students. Its new location was Sapporo, and its new name was the Sapporo Agricultural College. The Government dealt liberally in grants of land, but these ample acres have since been mostly confiscated, leaving only sufficient for educational purposes. Few can estimate the wonderful uplift which has come to Japan through this efficient school. In 1893 it had sent out from its agricultural

course 123 graduates; from the engineering, 4; military, 42; and from the practical department, 114.

In 1874 an agricultural department was added to the Imperial University at Tokio, the original location of the Sapporo College. An exhaustive syllabus in the Department of Agriculture provides examination for many profound students of this science, and admits them to the highest university degree. Four courses are open in the university—viz., agriculture, agricultural chemistry, forestry, and veterinary medicine. In 1895 there were 261 students of agriculture in the university.

From this extended though by no means exhaustive review of the status of scientific instruction in agriculture throughout the world, it is evident that all the progressive nations have caught the inspiration which attaches to this branch of education, and are swinging into line in their efforts to adopt it. Old ideals are rapidly giving place to the new. Educators are forced to admit that mental culture is as possible under the study of science as by the protracted study of languages and literature; that such study aids vastly more than the latter in the training which prepares men for the active duties of life; and that if the development of husbandry as a pursuit does not keep pace on an intelligent basis with every other technical pursuit, national greatness and permanence will never be achieved.

EASTERN OYSTER CULTURE IN OREGON.

By F. L. WASHBURN, A. M.,
STATE BIOLOGIST AND PROFESSOR OF BIOLOGY IN THE UNIVERSITY OF OREGON.

DURING the past two years the United States Fish Commission, with characteristic enterprise, has been carrying on experiments in the propagation of Eastern oysters in the bays of the Oregon coast. Work of a similar nature is now being undertaken in the State of Washington.

As the result of an application through official sources, re-enforced possibly by the results of a biological survey made by this department during the preceding summer, twenty-two barrels of Eastern oysters were, on November 7, 1896, deposited on a portion of Oysterville Flat, so called, in Yaquina Bay, Oregon, seven miles and a half from the ocean. The oystermen of that section have agreed to abstain from tonging for native oysters upon the portion of the flat thus reserved until sufficient time has elapsed to justify an opinion as to the result of the experiment. These introduced oysters were of two varieties—the long, slender East Riv-

ers and the more oval, fan-shaped, and ribbed Princess Bays. Their journey of twelve days across the continent, in sugar barrels, from New York to San Francisco and thence to Oregon without

"Oyster City," Yaquina Bay, Oregon.

water did not cause the mortality one might expect, for in strewing them over the bed from the scows of the oystermen very few dead individuals were observed—certainly not one half of one per cent.

This alien oyster has much to contend with here. It was realized that the cold and salt water rushing in from the Pacific—colder and salter by far than in their Atlantic home at the same time—if it did not entirely prevent spawning would at least make the survival of the young embryos a matter of doubt; yet it was hoped that perhaps, after a number of years, the oysters might become acclimated, as it were, and their spawn, inheriting their parents' acquired hardiness, we might present to the people of the State a new form of Oregon product in the shape of Eastern oysters hatched and grown in the waters of this bay. Notwithstanding the fecundity of this oyster, a female producing in the vicinity of sixty million eggs at a spawning, it must be remembered that even under the most favorable conditions in its own home, where the water has in summer a fairly constant temperature of over 70° F. and a salinity of 1.012 on an average, but a very small proportion of this multitude survive. How much more unlikely is its survival in the waters of Yaquina Bay, Oregon, where the writer has seen the water change from a temperature of 70° F. and a saltness of 1.012 to a temperature of 55° and a salinity of 1.022 within six hours! It was to save the young embryos from exposure to these and kindred dangers that I, as a volunteer employee of the United

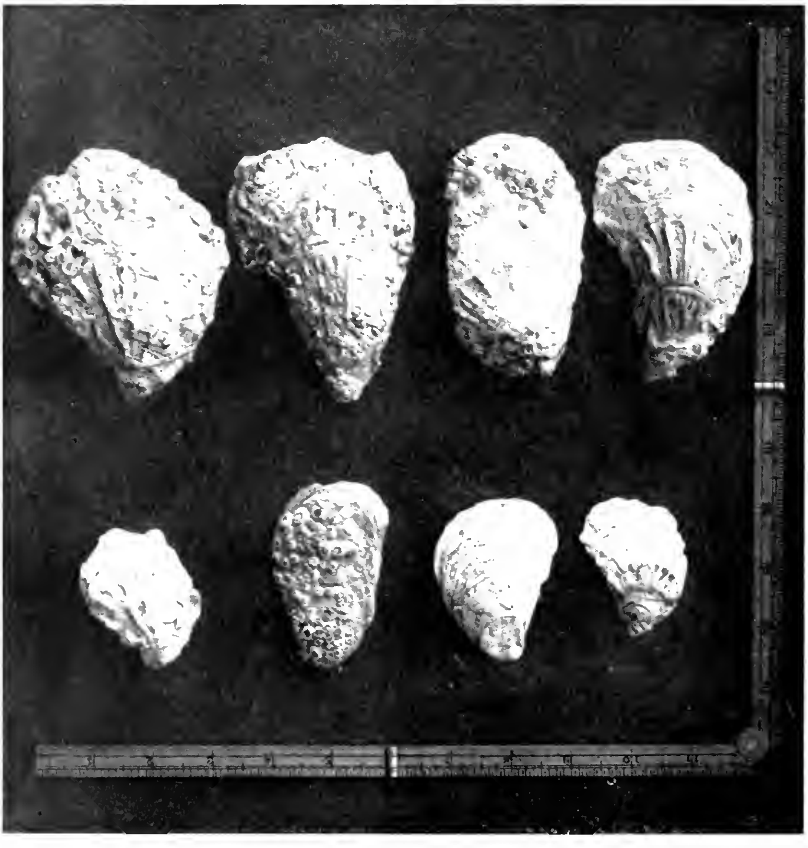
States Fish Commission during the summers of 1897 and 1898, among other things resorted to the artificial fertilization of the eggs in a temporary laboratory, carrying the delicate embryos to the swimming stage and dumping them by thousands into the bay. Given some clean crocks, a microscope, dissecting instruments, tumblers, rubber tubing, thermometers, and instruments to test the saltness of the water, and innumerable embryos can be cared for without much trouble. The process, as practiced by Brooks, Ryder, Nelson, and others in America, is too well known to need repeating here. Its efficacy is well established, and, in spite of the incredulity of the oystermen, who wished to see the oysters spawn "spontaneous," as they expressed it, an incredulity amounting almost to opposition, the writer has persevered in this work for two seasons and intends to continue it the coming summer.

The native oyster of this Northwest coast (*Ostrea lurida*), smaller and by many preferred to its Eastern congener, while it is far less fruitful in its spawning than the latter, retains its young within the parent shell until long after they have passed the tender stages, when they leave the mantle cavity of the parent to swim for themselves. This oyster could rightly be called viviparous, while the Eastern oyster is oviparous. On account of its nurse-acting pro-

An Experimental Spawning Float.

clivities this West-coast oyster has an immense advantage here over the introduced species. The latter's eggs have to run the following gantlet: (1) Not meeting with a fertilizing cell and perishing in consequence; (2) sinking, before or after fertilization, in the fatal mud; (3) being eaten by small fish and other minute animals;

(4) being killed by sudden changes in the temperature and density of the water. Artificial fertilization and the rearing of the embryos in the laboratory largely eliminate these dangers. We have adopted other methods to insure success. A few of the oysters were removed from the Government plant and deposited two miles farther up the bay, nine miles and a half from the ocean, where it was thought the water was warmer, less salt, and less variable



Eastern Oysters in Oregon. The lower row shows size when planted in 1896; the upper row represents their appearance in 1898.

than on Oysterville Flat. Some, during the breeding season, were placed on spawning floats and anchored near the shore, where the shallow water is thoroughly warmed by the sun. It was in one of these floats that the oystermen had an opportunity to see the oysters spawn "spontaneous," for the water therein, reaching 70° F., became milk-white with spawn or milt within an hour after the oysters had been taken from the plant. This was really our first proof that the introduced oyster would spawn here. Some were

1, native oyster spat on clam shell; 2, same on inside of oyster shell; 3, 4, 5, native spat (*Ostrea lurida*) on Eastern oyster shells; 6, showing size and appearance of native spat one or two months old.

placed in sloughs adjoining the bay, with the hope that favorable conditions would be met with there. Others were placed in artificially constructed salt ponds somewhat after the style used by the French.

What has been the outcome? The oysters, particularly the Princess Bay variety, have grown enormously and are in excellent condition. Until this spring no Eastern spat or young Eastern oysters had been discovered; this, of course, is the crucial point in the experiment; we know they will spawn, but will the spawn develop? Recently, much to our encouragement, a few young oysters, apparently of last summer's spawning, have been found and forwarded to Washington, proof positive that the oyster will propagate here, but not certain evidence of the practical outcome of the experiment. It is too early to predict results as yet; two years more are really required to tell the story.

For thirty years Eastern oysters have been shipped to San Francisco by enterprising firms of that city, planted there in the bay until a large size is attained, and then sold at an immense profit. These firms have always claimed that the Eastern oyster did not reproduce there. As far as can be ascertained from a reliable source, the shipments in recent years have rather increased than diminished, this fact being used as an argument to support the above statement. It is nevertheless a known fact that much Eastern spat and many adult oysters undoubtedly hatched there have been found by members of the United States Fish Commission and others. Moreover, with increasing trade one would naturally expect more shipments, even though the introduced oyster did propagate to some extent.

Ostrea lurida, the toothsome little native oyster which years ago was so abundant at Yaquina Bay, affording support to many families, has decreased in numbers to such an alarming extent that unless some radical measures are soon taken to prevent, the native oyster industry of this locality will be a thing of the past. This decrease in the size and numbers appears to be due to several causes. In the first place, there has been a very persistent tonging on a somewhat limited area. This might have been counterbalanced by proper precautions to insure a future supply, but, with characteristic lack of foresight, such precautions have been neglected, and the beds have been culled year after year, until the comparatively few oysters now marketed from Yaquina Bay are of very questionable size. Each oysterman has two acres of flats for private use. Three natural beds in the bay afford sources of supply for these private beds. The larger oysters tonged on the natural beds are marketed, and the smaller specimens spread on

the private ground referred to. Beyond strewing clean shells on these private beds, no provision is made to collect the swimming embryos during the spawning season, and multitudes must be carried away and lost. The writer has urged upon the oystermen the need of collectors of brush or tile, by the use of which the oysters which they have acquired may be largely increased in numbers, and will endeavor to demonstrate, by the use of tile collectors, that hundreds of young spat may be saved and raised to marketable age. Our native oyster structurally and physiologically resembles the European oyster (*Ostrea edulis*), and, like it, could be propagated in artificial oyster ponds. The practicability of such work on the West American coast depends, of course, on the market price of the resulting product as compared with the outlay required for labor.

MALAY FOLKLORE.

By R. CLYDE FORD.

THE Malay is an Oriental, and, of course, possesses a goodly number of superstitions and old wives' fables, but he does not hug them to his soul like some of the other peoples of the East—the Chinaman, for instance, who lives only by favor of gods, ghosts, goblins, and devils. The Malay lives in spite of spirits, good or bad, and tries to be a model Mohammedan at the same time. With bold assurance and positiveness, he puts his trust in Allah; but, after all, this does not keep him from cherishing, on the sly, a knowledge of a few uncanny, hair-raising beliefs any more than to be a devout churchman with us removes one from the occult influences of stolen dishcloths, overturned salt-cellars, and the phases of the moon.

The Malay man's *aberglaube*—his superstition—is undoubtedly of ancient origin. For five hundred years or more he has said his prayers five times a day in response to the muezzin's cry of *Allah ho akbar*, and his religion has penetrated the very life of his race and spread to the most distant confines of the archipelago, but it has never been able to remove entirely the heritage of that past when he was governed by Sanskrit gods or by deities of his own. Whatever he may have believed then and since changed, these fragments and relics of goblindom and superstition go back to that time, and so link on to all the weird love that prevailed in the ancient world. Another evidence of the primitiveness of Malay folklore may be seen in the fact that the inhabitants of the jungles and *padangs* and the aboriginal dwellers of mountains

and dense forests cherish much more heathen notions and greater elaborations of everyday superstitions than the more enlightened and modernized Malays of towns and *campongs*. In the East, as in the West, the man who lives close to Nature "holds communion with her visible forms," and likewise finds out, or thinks he does, a good deal about her invisible shapes.

The Malay has on his list of uncanny things the names of several spirits. Disease is everywhere a great dread of men, and often looked upon as an infliction of the supernatural powers. There are several spirits of sickness recognized among the Malays, but they reserve their greatest horror for the influences of the *Hantu Katumbohan*, or spirit of smallpox. But other spirits abound; there are some that inhabit the sources of streams, and many that dwell in forests. Mines, too, have their patron goblins, which are propitiated by the miners. The sea-going Malay, also, whose vision has been clarified by bitter salt spray, knows and frequently sees the spirits that inhabit certain parts of the ocean.

The *Hantu Pemburo*, or phantom hunter, is a spirit the Malays take special account of; in general, he seems to resemble the *wilde Jäger* of German folklore. Long ago, so the story has it, there lived a certain man and his wife in Katapang, in Sumatra. One day the wife fell sick, and, thinking the flesh of a mouse-deer might strengthen her, she asked her husband to kill one for her. He went forth on the hunt, but was unsuccessful and soon returned. His wife now became very angry, and told him to try again—in fact, not to return till he could come home with the coveted game. The man swore a mighty oath, called his dogs, took his weapons, and set out into the forest. He wandered and wandered, and always in vain. The days ran into months, the months became years, and still no mouse-deer. At last, despairing of finding the animal on earth, he ordered his dogs to bay the stars, and they sprang away through the sky, and he followed. As he walked with upturned gaze, a leaf fell into his mouth and took root there.

At home things were not going well. His son, born after his departure, when he became a lad, was often taunted by the other children of the *campong*, and twitted of the fact that his father was a wandering ghost. After hearing the truth from his mother, the boy went out into the forest to meet the huntsman. Far from the haunts of men, in the depths of the forest, they met and conversed. The boy told of his wrongs, and the father vowed to avenge them, and ever since that time, say the Malays, he has afflicted mankind. At night he courses through the wood and

sky with a noisy, yelping pack, and woe to the man who sees him! On the peninsula the people mutter this charm to ward off his evil influence:

> "I know thy history,
> O man of Katapang!
> Therefore return thou
> To thy jungle of Mohang,
> And do not bring sickness upon me."

The Malay is a firm believer in the efficacy of charms. He wears amulets, places written words of magic in houses, and sports a tiger's claw as a preventive of disease. If he is specially primitive and backwoodsy, when he enters a forest he says: "Go to the right, all my enemies and assailants! May you not look upon me; let me walk alone!" To allay a storm he says: "The elephants collect, they wallow across the sea; go to the right, go to the left, I break the tempest." When about to begin an elephant hunt, according to Thompson, he uses this charm: "The elephant trumpets, he wallows across the lake. The pot boils, the pan boils across the point. Go to the left, go to the right, spirit of grandfather (the elephant); I loose the fingers upon the bowstring."

The Malay believes in witches and witchcraft. There is the bottle imp, the *Polong*, which feeds on its owner's blood till the time comes for it to take possession of an enemy. Then there is a horrid thing, the *Penangalan*, which possesses women. Frequently it leaves its rightful abode to fly away at night to feed on blood, taking the form of the head and intestines of the person it inhabited, in which shape it wanders around.

Such beliefs may perhaps have their origin in metempsychosis, which in other ways has some foothold among the common people. For instance, elephants and tigers are believed sometimes to be human souls in disguise, and so the Malay addresses them as "grandfather" to allay their wrath and avoid direct reference to them. Crocodiles also are often regarded as sacred, and special charms are used in fishing for them. One such, given by Maxwell, is as follows: "O Dangsari, lotus flower, receive what I send thee. If thou receivest it not, may thy eyes be torn out!"

The domestic animals also figure in Malay folklore. Dogs are unlucky and regarded with suspicion, for they would like to lick their master's bones. Cats, on the other hand, are lucky, and show a fondness for their owners.

Owls are regarded as birds of ill omen, and their hooting forebodes death.

Days are lucky and unlucky. Monday, Wednesday, and Fri-

day are fortunate birthdays, and a dream on a Thursday night will come true. To dream of a dog or a flood is unlucky. To stumble when starting on a journey is a bad sign, and before setting out on a pilgrimage to Mecca certain formulas are muttered and signs followed.

The Malay hates to tear down a house, and so the old one is left standing when a new one is built. The ladder of a house must be built just so, or disaster comes to the owner or builder; and to knock one's head on the lintel is regarded as unfavorable. One rises quickly from a meal; otherwise, if he is single, he may be regarded with disfavor by his prospective father-in-law.

As one travels over the archipelago he finds that superstitions vary, and what may be regarded by the Malays of the peninsula as particularly ominous may have no meaning at all with the Malays of the south or east. The Dyaks of Borneo are probably the most uncivilized of all the Malay tribes, for Mohammedanism has taken but little hold upon them, and their natural paganism remains as yet unshaken. Of their folklore we know but little. It awaits the conquest of the West, like the island itself.

ELECTRICITY FROM THALES TO FARADAY.

By ERNEST A. LESUEUR.

IT is so common a notion nowadays that electricity had its birth and rise in the nineteenth century that it gives one a strange mental sensation to contemplate the fact that all the myriads of commercial applications that have of late years been developed in this field might have been made by the Chinese or the ancient Egyptians, so far as the potentiality of Nature for developing electrical phenomena is concerned. The writer used to know a delightful old gentleman in Vermont who once referred, as to a well-known fact, to Edison's having invented electricity. It is astonishing how closely his state of mind typifies that of a great many people.

In the form of the lightning, the aurora, and the shock of the electric eel or torpedo, electrical manifestations have been known ever since man commenced to observe those phenomena, but the fossil resin amber was the substance which eventually gave its name to the now tremendous agency. This material was observed, many centuries before our era, to possess the property of attracting light bodies to itself when rubbed with wool, and, being called ἤλεκτρον (electron) by the Greeks, transmitted its name to the property or force which it thus brought into evidence. The fact is mentioned as

early as 600 B. C., by Thales of Miletus, although he does not transmit to us the name of the original observer of the phenomenon. Homely as was the experiment, it marked a beginning in electrical research.

Not that scientific investigations in that or any line were pushed very assiduously in those days, for there is a great gap between the discovery of the property above alluded to and the acquisition of any more solid knowledge pertaining to electricity. The phenomenon was at that time set down in the list of natural facts, and no attempt appears to have been made to connect it with others. The inquiring spirit of the present age can hardly be brought into more striking relief than by a comparison of the, at present, almost daily advances in scientific knowledge with the fact that twenty-two hundred years elapsed between the discovery of the above-mentioned power of amber by the ancients and the later one that a very large number of other substances, such as diamonds, vitrefactions of all kinds, sulphur, common resin, etc., possess the same property. A few other scattered facts were, however, also noted by the ancients: fire is said to have streamed from the head of Servius Tullius at the age of seven, and Virgil asserts that flame was emitted by the hair of Ascanius.

In examining, now, the history of the rise of electrical science we find, as just mentioned, the vast gap of over two millenniums between the discovery of the attracting power of rubbed amber and the mere extension of man's knowledge so as to include other substances. The philosophers Boyle and Otto von Guericke, who were active during the latter half of the seventeenth century, added a mass of new data in this line. Boyle, moreover, discovered the equivalence of action and reaction between the attracting and the attracted body, and that the rubbed amber or other "electric" retained its attractive powers for a certain period after excitation had ceased.

Otto von Guèricke made a vast step forward by constructing the first electrical machine, in a crude form, truly, but which proved of the utmost service in adding to our knowledge of the properties of electricity. His machine was constructed very simply of a globe of sulphur mounted on a spindle, which could be rotated by means of a crank; the operator applied friction with the hand, his body receiving a positive charge, while the surface of the sulphur acquired a negative. The fact of the two electrifications being separated at the surface of the sulphur was not, however, known at the time; the only charge that Guericke observed being that appearing on the sulphur. The reason for this was that the latter, being a nonconductor, any electricity generated upon it was compelled to stay there,

for a certain time at least, and consequently accumulated so as to be observable; whereas the opposite electrification flowing into the operator's hand continuously escaped to earth without giving any sign of its presence. Had the operator stood upon an insulating support, the electrification would have accumulated on his body as well as upon the sulphur. Guericke made the discovery that a light body, having been once attracted to an electrified surface, was almost immediately repelled from it, and could not be again attracted without having its imparted electrification removed by contact with an uncharged surface.

Sir Isaac Newton, about 1675, made an interesting application of a principle allied to this. He used a hollow, drum-shaped contrivance with glass ends and a very short axis, into which he put a number of fragments of paper. On briskly rubbing the outside of the glass with a piece of silk the paper was caused to "leap from one part of the glass to another and twirl about in the air." This was repeated in 1676 before the Royal Society, to the great edification of that learned body.

Newton made a considerable improvement in the electrical machine of Guericke by the substitution of a hollow globe of glass for Guericke's sulphur one. What is chiefly interesting about the improvement is the fact that Guericke's sulphur globe, of comparative weight and cumbrousness, was made by casting melted sulphur into a glass globe and then breaking off the glass. Guericke observed in the dark a peculiar luminosity of conducting surfaces when well charged by means of his machine; he compared it to the phosphorescent light observed when lump sugar is broken in the dark. It was what is now known as the brush-discharge effect.

In 1705 Francis Hawksbee discovered the peculiar phenomenon which he termed the mercurial phosphorus. It was produced by causing a stream of well-dried mercury to fall through an exhausted glass receiver. The friction of the particles of mercury against the jet piece and the glass caused an electrification which evinced itself in a phosphorescent glow. The receiver, indeed, had not to be by any means thoroughly exhausted, the phenomenon occurring at an air pressure up to about fourteen inches of the barometer.

The crackling noise and the spark accompanying electrical discharge suggested about this time the analogy of those miniature disturbances to thunder and lightning, but the identity of the two was not fully established until later.

Up to this time the fact that certain substances were capable of conducting electricity was not known, but in 1729 Stephen Gray, F. R. S., an enthusiastic investigator, made the discovery, and at the same time the cognate one that a large class of materials are non-

conductors. The only source of electricity which was at the disposal of experimenters up to this time was the electrical machine, improved, as described, by Newton, which furnished intermittent currents (discharges) of infinitesimal quantity, as we should say now, but of extremely high pressure. This fact of the enormous pressure resulted in the electricity's forcing its way through very imperfect conductors, so as to cause our investigators to rank many of these latter with the metals. Thus Gray concluded that pack thread was a good conductor because it did not oppose sufficient resistance to prevent the flow of his high pressure (or, as we should now say, high voltage or tension) electricity. He tried wire as well, but did not realize it was a better conductor than the thread, although its conductivity was actually in the millions of times as great. In collaboration with his friend Wheeler he conveyed electrical discharges a distance of eight hundred and eighty-six feet, through presumably air-dry pack thread—an achievement which would almost be notable at the present time. He insulated the line by hanging it from loops of silk thread.

Gray hoped "that there may be found out a way to collect a greater quantity of electric fire, and consequently to increase the force of that power, which, *si licet magnis componere parva*, seems to be of the same nature with thunder and lightning."

About this time Desaguliers discovered that those materials which, upon being rubbed, develop electrical charges, are all nonconductors, and that, conversely, nonelectrics are conductors. The terms electrics and nonelectrics were applied to bodies respectively capable and incapable of excitation; the words idioelectrics and anelectrics were also used in respectively equivalent senses.

In France, Dufay discovered that the conductivity of pack thread was greatly improved by the presence of moisture, and he succeeded in conveying a discharge a distance of almost thirteen hundred feet. He suspended himself by silken cords and had himself electrified, and then observed that he could give a shock accompanied by a spark to any person standing on the ground.

He also established the fact of the two opposite kinds of electrification, and gave them the names of vitreous and resinous, from the fact that the former was developed by the excitation of glass and vitreous substances generally, and the latter from that of amber and resins. He observed that the distinguishing characteristic of the two was the fact that opposite charges attracted each other, while similar ones exerted mutual repulsion. Dufay and Gray died within three years of each other, both at the age of forty, Gray having added to the results already mentioned the discovery of the conducting powers of certain liquids and of the human body.

Experimental research now began to spread into Germany and the Netherlands. The electrical machine was greatly improved by Professor Boze, of Wittenberg, and Professor Winkler, of Leipsic, who respectively added the prime conductor and the silk rubber to that important piece of apparatus. A Scotch Benedictine monk of Erfurt—Professor Gordon—substituted a glass cylinder for the sphere, and thereby brought the instrument in its essentials practically to the form in which it exists to-day. The improvement enabled the production of very large sparks, which were caused to produce the inflammation of various combustibles. Gordon went so far as to ignite alcohol by means of a jet of electrified water.

We now come to an epoch-making discovery—that of the condenser, or, in its conventional laboratory form, the Leyden jar. Professor Muschenbroeck, of the University of Leyden, was struck with the idea that it would be a good plan to try to prevent the dissipation of the electric charge by inclosing the conductor containing it in an insulating envelope. He therefore took a glass jar, partly filled it with water, and electrified the latter. His assistant, who was holding the bottle, accidentally touched the wire which made connection with the water, and received on the instant a shock much more violent than any that the electrical machine was capable of giving. This led to the discovery that as the charge of vitreous electricity had accumulated in the water, a corresponding charge of the opposite kind had gathered upon the outside of the glass and been "bound" there, as it is called, by the attraction exercised upon it by the charge on the inside. It had been enabled to get upon the glass by the fact of the assistant's hand having covered part of the surface of the latter, and, since he stood upon the ground, the electricity had quietly flowed from the latter up through his body to the outside surface of the glass.

The apparatus was quickly perfected by coating both the inside and outside of a jar with tin foil, applying the charge by means of a wire or chain to the inside coating and allowing the outer one to stand upon the earth or upon a conducting substance in electrical contact with the latter. The exaltation of spirit with which the discovery was hailed by the *savants* appears to have been extraordinary—one student who took a discharge through his body being reported to state that he would not have missed the experience for a fabulous consideration, and that he would not repeat it if it were to save his life. In reality the advance was enormous; it gave a means for literally bottling up electricity in quantities previously unthought of. The prime conductor of an electrical machine could not retain any considerable quantity of electricity for the reason that, a certain small intensity of electrification having been reached,

the addition operated to upset the balance, so to speak, and the electricity escaped by a sudden (disruptive) discharge, or spark, or by the brush discharge already alluded to. With the Leyden jar, however, as fast as electricity was supplied to the inside coating it became "bound" there by the charge of opposite sign accumulating on the outside, and the limit of capacity of the jar was simply one of strength of the glass: if too much electricity was supplied, the stress of mutual attraction between the two charges relieved itself by destroying the jar.

Although Professor Muschenbroeck discovered the principle in the manner above referred to, it appears extremely probable that two other investigators, working independently, also did the same. One Cuneus and a monk named Kleist each claimed the honor of original invention of the condenser.

About 1747 the first gun was fired by electricity; this was accomplished by Sir William Watson, who also succeeded in kindling alcohol and gas by means of a drop of cold water and even with ice. The same experimenter reversed the ordinary procedure of causing the electric influence to pass from an electrified body to the one to be experimented upon, the latter being unelectrified, by electrifying the latter, and then producing the desired effect by approaching it to an unelectrified one.

A party of the Royal Society with Watson as chief operator instituted a series of researches on a grand scale to determine, if possible, the velocity of the electric discharge, and arrived at a number of conclusions which, however, were of a decidedly negative nature. The most important of these were as follows: That they could not observe any interval between the instant of applying the discharge to one end of the line and its reception at the other; that the destructive effects of discharge are greater through bad conductors than through good ones; that conduction is equally powerful whether occurring through earth or water.

Just previous to this there had been some brilliant experiments carried on in France, and the discharge had been conveyed through twelve thousand feet of circuit, including the acre basin of the Tuileries, but they had not been performed as systematically, or with the definite objects in view, as had the English experiments.

The following year the Royal Society continued its researches on a larger scale than previously, using 12,276 feet of wire, and found that even through that length the velocity was practically instantaneous.

Watson urged as a theory that electrical disturbances were caused by influx or efflux of a single electric fluid from the state of normal electrification, thus differing from Dufay in his opinion as to the

existence of two fluids. He was led to this belief by observing that he obtained a larger spark between two oppositely electrified bodies than from either to the earth.

From this time on there appears upon the scene a host of workers in this field, one of the most prominent being the distinguished American, Benjamin Franklin. Somewhat previous to his remarkable work, or about 1750, Boze made certain discoveries in the matter of the surface tension of conducting liquids being diminished by electrification, and Mowbray and Nollet ascertained that the vegetation of flowers and of vegetating seeds was hastened by electrifying them.

Franklin (born 1706, died 1790) made the important discovery of the active discharge of electricity from an electrified body by points as well as the converse of it—i. e., that electricity was rapidly abstracted from a charged atmosphere by points. This enabled him to increase the efficiency of the electrical machine by adding a comb-shaped series of points to the collector of the prime conductor.

Up to this time, although the identity of lightning with electricity had long been suspected, it had not been at all established, and to Franklin may be said to belong the honor of doing so, although in this, as in the case of the invention of the Leyden jar, there appears to have been successful contemporaneous research elsewhere. Before performing his great experiment Franklin published a book strongly supporting the belief in the identity of the two. Once having conceived the idea of drawing electricity from the upper atmosphere, he unfortunately lost some time through waiting for the completion of the spire of a certain church in Philadelphia, from the top of which he hoped to be able to collect electricity by means of a wire, but finally hit upon the device which now fills much the same place in connection with his memory that the classical cherry tree does with Washington's—the lightning-collecting kite. This apparatus was very simply constructed, and had a pointed wire projecting a short distance above the framework. It was controlled, and electrical connection made, by an ordinary string which terminated in a short length of silk ribbon to protect the person from possible injury, and to give electricity a chance to accumulate in the system, by insulating the "line." At the end of the string proper Franklin fastened a metallic key. In company with his son he flew the kite during a thunderstorm which occurred in June, 1752; for some time no electric disturbance approached the neighborhood, and he was on the point of abandoning the experiment when he observed what he had been waiting for—the outer fibers of the string standing out from the latter by repulsive force—and, applying his knuckle to the key, he drew a spark. Subsequently, when the rain soaked the string and caused it to conduct much better, there was a fine supply

of electricity, and Franklin charged a Leyden jar from the key, thus achieving the actual storage of "lightning."

He continued his investigations in atmospheric electricity, and discovered that the electrification of the clouds (or of the upper atmosphere) was sometimes positive and sometimes negative. The invention of the lightning rod is due to him.

Franklin sided with Watson in his belief in the single nature of the electric fluid.

As intimated above, atmospheric electricity appears to have been collected independently about the same time in Europe, and certain very daring and dangerous experiments were performed there. One sad occurrence, as a result, was the death of Professor Richman, in St. Petersburg, in 1753. Richman, in company with a friend, Sokolow, was taking observations on an electroscope connected with an iron rod which terminated in the apartment and extended in the other direction above the roof of the building. During the progress of their experiments a violent peal of thunder was heard in the neighborhood, and Richman bent to examine the instrument. In doing so he approached his head to within a foot of the end of the rod, and Sokolow saw a ball of fire "about the size of a man's fist" shoot from it to Richman's head with a terrific report. The stroke was, of course, immediately fatal, and what we now know as the return shock stupefied and benumbed Sokolow. The unfortunate event served as a warning to other daring experimenters.

Canton, another prominent worker in this field, discovered that the so-called vitreous electricity was not necessarily always developed by the friction of glass, as had hitherto been believed to be invariably the case. By applying different rubbers to glass he obtained either positive or negative at pleasure. This at once disposed of the idea that one kind of electricity resided in certain bodies and its opposite in others. Canton also made the interesting discovery that glass, amber, rock crystal, etc., when taken out of mercury, were all electrified positively. He was thus enabled to make the improvement in the electrical machine of coating its rubber with an amalgam rich in mercury, which greatly enhanced its powers.

Among the numerous names now coming into prominence must be mentioned those of Beccaria, Symmer, Delaval, Wilson, Kinnersley, Wilcke, and Priestley.

The first named, Father Beccaria, was a celebrated Italian physicist who did most valuable work in connection with atmospheric electricity, and who published several classical works on that and allied subjects. Among these may be mentioned his *Lettre del Elettricità*, 1758, and *Experimenta*, 1772. He ascertained that water is not by any means a good conductor, as it had previously been sup-

posed to be, and, by using pure water, he caused the electric spark to become visible in it, a phenomenon capable of occurring only through media almost nonconducting. In these experiments he used thick glass tubes with wires led through the opposite ends, the latter being sealed, and the tubes filled with water. These were invariably shattered by the passage of the spark on account of the accompanying elevation of temperature, which caused expansion. He also established the facts that the atmosphere adjacent to an electrified body acquires electrification of the same sign by abstracting electricity from the body, and that the air then parts with its electricity very slowly. He advanced the theory that there is a mutual repulsion between the particles of the electric fluid and those of air, and that a temporary vacuum is formed at the moment of the passage of a disruptive discharge or spark.

Robert Symmer, in 1759, described some most entertaining experiments, making use of the opposite electrifications of superposed stockings of different materials or merely of different colors (the dye matters in the latter case causing differentiation). If, in a dry atmosphere, a silk stocking be drawn over the leg and a woolen one pulled over it, the two will be found, upon being removed, to be very powerfully electrified in opposite senses. If the four stockings of two such pairs be used and then suspended together, they will indulge in remarkable antics due to each of the silk stockings trying to attract both of the woolen ones, and *vice versa*, and, on the other hand, each of each kind repelling the other. The amount of electrical attraction and repulsion produced in this simple way in a dry atmosphere is remarkable. The experiment may also be performed with all silk stockings, one pair white and the other black.

Symmer advanced the theory of two fluids coexisting in all matter (not independently of each other, as had been previously supposed), which by mutual counteractions produced all electrical phenomena. His conception was that a body, positively electrified, did not exist in that condition because of the possession of a charge of a positive (as distinct from a negative) electric fluid which it had not held before, and did not hold in a normal state; nor that it possessed a greater share of a single electric fluid than it did in an unelectrified condition, as had been believed by Franklin and Watson, and by Dufay respectively; but that such a body contained both positive and negative electricities which, when the body behaved as "unelectrified," entirely counteracted each other, but which, on the other hand, caused a positive or negative charge to be evinced should either positive or negative electricity respectively preponderate.

Æpinus was the author of another notable theory, of which we must omit further mention for want of space.

Disjointed observations connected with animal electricity had been accumulating for many centuries. The first chronicled note that refers to the subject dates back to 676 A. D. Whether or not entirely by chance, the Arabians named the electric eel, or torpedo, in a way that impresses us now as singularly felicitous, *raad* (the lightning). Toward the end of the last century Redi discovered that the shock was sometimes conveyed through the line and rod to the fisherman, and Kampfer compared the effects to those of electrical discharges. It does not appear, however, that the resemblance was actually believed to be more than accidental until Bancroft urged, in the last ten years of the eighteenth century, the view which was shortly proved. Investigation since has shown that several other aquatic animals possess this astonishing manifestation of vitality, notably the *Gymnotus electricus* (Surinam eel), the *Trichiurus electricus,* and the *Tetraodon electricus.* Humboldt gives an account of wonderful battles in South America between gymnoti and wild horses. In fact, the most expeditious method, if not the most humane one, of capturing these alarming creatures appears to be to drive horses into the pond inhabited by them, and to allow the eels to exhaust their strength by repeated electric discharges before endeavoring to bring them to land by other means.

Cavendish was one of the most noted experimental investigators in the electrical field during the latter third of the eighteenth century. His work was remarkably accurate, considering the lack of a proper equipment for taking observations incident to operations in those days. He computed the relative conductivities of iron and water as four hundred million to unity, and found that the addition of but one part of common salt to one hundred of water increased the conductivity of the latter a hundredfold. A twenty-six-per-cent solution of salt he found to possess only seven and one quarter times the conductivity of the extremely weak one mentioned. He also established the law that the capacity of condensers (of which the previously mentioned Leyden jar is an example) varies directly as the active area, and inversely as the distance separating the conducting surfaces. It was reserved for later investigators to make the grand discoveries which relate to electrochemical dissociation, but Cavendish succeeded in accurately determining the ratio of combination of the elements of water in a method which superficially suggests the inverse of electrolytic decomposition—i. e., by inducing the combination of hydrogen and oxygen by the electric spark in the instrument known as the eudiometer.

Hard on the heels of this work came news of Galvani's remarkable discovery (1790) of the fact that freshly amputated frogs' legs, on being touched along the lines of the muscles by dissimilar metals,

were powerfully agitated. We can only speak of this discovery as the stumbling on to an isolated fact, for it was reserved for Volta to establish the generalization that a current is produced in the conductor joining dissimilar metals when the latter are both in contact with a suitable electrolyte (or liquid capable both of conducting electricity and of acting on one, and incidentally also sometimes both, of the metals). Meantime (Du Bois-Reymond observes), "wherever frogs were to be found, and where two different kinds of metal could be procured, everybody was anxious to see the mangled limbs of frogs brought to life in this wonderful way. Physiologists believed that at last they should realize their visions of a vital power, and physicians that no cure was impossible."

Volta first discovered merely the fact of electrification by contact. He wrote to Galvani: "I don't need your frog. Give me two metals and a moist rag, and I will produce your animal electricity. Your frog is nothing but a moist conductor, and in this respect it is inferior to my wet rag!" Nobili, nevertheless, in 1825 proved the existence of galvanic currents in muscles.

Later on Volta invented the "*couronne des tasses*" (crown of cups), thus at the same time adopting the general form of cell used, with modifications, to-day, and producing the higher electromotive force, or electrical pressure, consequent on the multiplication of the cells in a series battery.

Just before Volta's celebrated communication to the Royal Society, in 1800, Fabroni, of Florence, in discussing Galvani's phenomenon, went to the root of the matter by suggesting that the energy of chemical action was at the bottom of galvanic manifestations, and he was warmly upheld in this contention by Sir Humphry Davy, who, upon the publication of Volta's discoveries, constructed a most elaborate battery with which (apparently about 1806) he produced the arc light between carbon pencils.

In the year referred to, Davy published the results of a series of experiments of enormous significance, among other things of the isolation of the alkali metals, sodium and potassium, whose existence had hitherto not been dreamed of. The simple electrolytic decomposition of water had been accomplished by Nicolson and Carlisle in the last year of the eighteenth century. Sir W. S. Harris says: "A series of new substances was speedily discovered, the existence of which had never before been imagined. Oxygen, chlorine, and acids were all dragged, as it were, to the positive pole, while metals, inflammable bodies, alkalies, and earths became determined to the negative pole of the battery. When wires connected with each extremity of the new battery were tipped with prepared and well-pointed charcoal, and the points brought near each other,

then a most intense and pure evolution of light followed, which on separating the points extended to a gorgeous arc." It was at first supposed that the galvanic or voltaic electricity was distinct from the so-called "frictional" or "ordinary" electricity.

A distinguished contemporary of Cavendish was Coulomb, the value of whose work in developing certain exceedingly important mathematical laws with regard to action at a distance, surface densities, and rates of charge dissipation can hardly be overestimated. His name was given to the torsion balance which, since his day, has been the standard instrument for measuring electric and magnetic attractions and repulsions. The importance of his work has since been recognized by the perpetuation of his name in connection with the unit of quantity of electricity, as that of Volta has been honored by its use, abbreviated (volt), to designate the unit of electrical tension or pressure.

Certain highly instructive and interesting data were accumulated about this time by Volta, Laplace, Saussure, and the renowned chemist Lavoisier, in connection with the subject of electrification produced when evaporation, and the liberation of gases and vapors in general from any cause, occurs. The liquid, solid, or mixture liberating the gas was contained in a metallic dish and the resultant electrification of the latter examined qualitatively. Volta's observations led him to conclude that the electrification was always negative, but Saussure demonstrated finally that its sign was dependent on the material of the dish. These experimenters covered, between them all, a somewhat extensive field, examining, among other things, the electrification resulting from the ebullition of various liquids, from the ordinary combustion of fuel, and from the decomposition of acids by metals to liberate hydrogen.

About the end of the first decade of the century Poisson attacked the phenomena of electricity analytically, and succeeded in demonstrating the right of electrical investigation to rank among the exact sciences. Of his most important mathematical propositions is one in which, assuming as a working hypothesis the existence of two mutually attracting fluids, he deduced formulæ covering the distribution of these fluids on the surfaces of two conducting spheres, in or out of contact.

A great deal of work was done during the end of the last century and the beginning of the present one on what is now known as pyro-electrification. The Abbé Haüy discovered that fragments of tourmaline crystal exhibited opposite electrifications on opposite extremities of their lines of cleavage. It is this crystal also which has unusually remarkable powers of polarizing light, and which, under electro-magnetic stress, suffers modifications of the latter property.

Haüy investigated the field with much diligence, and succeeded in cataloguing a large number of natural crystals by the side of tourmaline. The subject was amplified later by Sir David Brewster, who added a series of artificial crystalline salts to the list of pyro-electrical materials, among them, notably, hydro-potassic (and sodic) tartrate. The property was found not always to reside on these substances, but to be developed by heating them. Brewster found that even powdered tourmaline exhibited opposite electrifications on the opposite extremities of each tiny particle, causing the latter to act, so far as attractions and repulsions went, as infinitesimal magnets.

Our rapid and imperfect survey has now brought us to the threshold of the great activity in electrical work elicited by the tremendous discovery, made by Professor Oersted, of Copenhagen, of the existence of the electro-magnetic field. It happens that two of the most amiable and estimable individuals that have ever devoted their lives to scientific research stand out in this connection head and shoulders above all other investigators—Ampère and Faraday, the latter sixteen years younger than the former and destined to long survive him.

WINGLESS BIRDS.

By PHILIPPE GLANGEAUD.

IT is often said that there are no rules without exceptions. We purpose to test the truth of this maxim once more. Fishes are made to live in water, but some of them pass the greater part of their existence in mud. Some even perch upon trees, thus competing with birds, whose kingdom is the air, and which are able, with the aid of their wings, to plunge into space and travel rapidly over considerable distances. Yet there are birds, deprived by Nature, which do not possess the wing characteristic of the feathered tribe, and are consequently, like the majority of animals, pinned to the soil.

Birds do not all have equal power of flight, which is closely related to the extent of the development of their wings. There exist all grades in the spread of wings between that of the condor, which is four times the length of the body, whereby the bird is able to rise to the height of nearly twenty-five thousand feet, and the little winglets of the auk, which are of no use to it. The penguins have still smaller wings, which are nothing more than short, flattened stumps, without proper feathers and covered with a fine, hairlike down which might be taken for scales.

Another group of birds exists, called appropriately *Brevipennes*,

the wings of which are so poorly developed as to be wholly unsuitable for flight. As an offset and just compensation for this, their long and robust legs permit them to run with extraordinary speed. For that reason they have been called running birds, in distinction from other kinds that constitute the group of flying birds. Among them are some gigantic birds, and also some that have no visible wings on the outside of their bodies, and may therefore be properly called wingless.

The ostrich is a member of this group. With its bare, callous head and short bill, its long, featherless neck, and its massive body, supported by long, half-bare legs, ending in two large toes; its very short wings, formed of soft and flexible feathers; and its plume-shaped tail, it presents a very special appearance among the birds.

The nandous, the American representatives of the ostrich, have still shorter wings, which have no *remigia* at all, and terminate in a horny appendage, and they have no tail feathers.

The cassowary and the emu also resemble the ostrich in many points, but their wings are still more reduced than those of the nandou. They are only slightly distinct, and can not be seen when the bird holds them close up to its body. In the *Apteryx*, the name of which, from the Greek, means without wings, the organs of flight are hardly apparent, and consist simply of a very short stump bearing a thick and hooked nail. The *Apteryx*, which is also called *Kiwi*, a native of New Zealand, is the most singular of living birds. The neck and the body are continuous, and the moderately sized head is furnished with a long beak resembling that of the ibis. Having long hairs similar to the mustaches of cats at its base, it is different from the bills of all other existing birds in possessing nostrils that open at its upper point. Although the *Apteryx* can not fly, it runs very fast, despite the shortness of its legs, and can defend itself very effectively against assailants by the aid of its long-nailed and sharp-nailed feet. The tail is absent like the wings. The very pliant feathers are extremely curious, of the shape of a lance-head, pendent, loose, silky, with jagged barbs, and increase in length as they go back from the neck. The bird is of the size of a fowl, and when in its normal position stands with its body almost vertical, and carries the suggestion of a caricature—resembling, we might say, a feathered sack, with only a long-billed head and the claws projecting, and one beholding it feels that he is looking at some unfinished creature. It is a nocturnal bird, of fierce temper, and has become rare in consequence of the merciless war that is made upon it. Everything is strange about it, even the single egg it lays, which weighs about a quarter as much as its body.

Together with the *Apteryx*, there lived in New Zealand a bird that reached the height of nearly twelve feet—the *Dinornis.* It and the *Phororhaces* and the *Brontornis*, which have been recently exhumed in Patagonia, might be regarded as the giants of birds. This bird was known to the natives as the *Moa*, and lived in troops like the ostriches. Its organization was very much like that of the *Apteryx*, from which it was, however, distinguished by its great size, long neck, and short beak. It seems to have had the aspect of an ostrich, with a feathered neck and no wings or tail. The feet of the *Dinornis*, with their three large toes, were really enormous. Isolated fragments of its bones suggest very large mammals, rather than birds. The femur and tibia are larger than those of a bear, the tibia alone being about four feet long, and the thickness, in the narrowest part, of the width of a man's hand, while it was more than seven inches in the thickest part. The sternum, on the other hand, was small, convex, and longer than broad. The wing could not have been visible on the outside of the body, for the bones that constitute them are proportionally smaller than those of the *Apteryx*. There was, therefore, a maximum reduction of the wing in this bird.

The *Dinornis* was covered with a rich plumage, and this was doubtless what led to its destruction, women preferring its plumes to all other ornaments. The large number of bones which have been discovered in the alluviums, the caves, and the peat bogs of New Zealand authorize the thought that the island was once inhabited by a considerable number of these birds, which were able easily to repel the attacks of other animals by means of their big feet. But they could stand no chance against Nature's more terrible destroyer—man—who, when seeking the gratification of his taste and fancy, does not hesitate to exterminate whole species. The natives of New Zealand still recall the history of these singular birds; their extermination seems to have occurred about the time the island was visited by Captain Cook (1767–1778). Moreover, some of the bones collected in later years still had animal matter upon them. Even parts of the windpipe have been discovered, mixed with charcoal, and evidences of cooking have been found.

A near relative of the *Dinornis*, which the Maoris regard as extinct, is the *Notornis*, of which only four living specimens have been found since 1842, the last one having been captured in the latter part of 1898.

The eggs of the *Dinornis* were very large, having a capacity of about a gallon and being equivalent to eighty hen's eggs. Still larger eggs than these, however, are known. In 1851 Isidore Geoffroy Saint-Hilaire exhibited, in the French Academy of Sci-

ences, eggs of a bird coming from Madagascar that had a capacity of two gallons. Some specimens of these eggs may be seen in the galleries of the Paris Museum, and still larger eggs have been found. The museum in London has one with a capacity exceeding eleven quarts, or equivalent to two hundred and twenty hen's eggs, or more than seventy thousand humming birds' eggs. It was thought at first that the bird which laid these gigantic eggs was still living, for natives of Madagascar spoke of having seen a bird of colossal size that could throw down an ox and make a meal of it. Such, however, were not the ways of the bird called the *Epiornis*, which had no talons or wings, and fed on vegetable substances. The description by the celebrated traveler Marco Polo of a great flying bird of prey, called a roc, has no reference to the *Epiornis*. M. Grandidier has demonstrated that this bird no longer exists in Madagascar, and that if man ever knew it the stories with marvelous details which the savages hand down from generation to generation make no mention of it. We owe to M. Grandidier, M. Milne-Edwards, and Major Forsyth what is known of the history of this large wingless bird, which resembles the *Dinornis* in several points. If its size was proportioned to that of its eggs it should have been twice as large as the *Dinornis*. It was not, however, but constituted a family represented by very diverse forms and of variable size, though never much exceeding eleven feet. The head was similar in appearance to that of the *Dinornis*, but the surface of the forehead was furrowed with wrinkles and cavities, indicating the presence of a crest of large feathers. A curious peculiarity was the opening of the Eustachian tube directly on the exterior. The cervical vertebræ are very numerous, while the sternum is much reduced. It is a flat bone, broad but very short, especially in the median part. The wing also has suffered a great regression, for it comprises only a thin, short rod, the humerus, and a small osseous mass representing all the other bones of the wing stuck together. The *Epiornis* had no wings externally visible. The bones of the feet were, on the other hand, of considerable size, and indicate that the bird that possessed them was larger than the *Dinornis*.

The *Epiornis*, according to M. Milne-Edwards, frequented the borders of waters, keeping among the reeds along lakes and rivers, for its bones are found associated with those of turtles, crocodiles, and a small hippopotamus. It most probably nested in the low plains around lakes.

Just as the *Apteryx* among birds, and the bison and the beaver among mammals, so the *Dinornis* and the *Epiornis* have been destroyed as man has extended his abode and his domination.

When we regard the fauna of Madagascar and of New Zealand we are struck by the great resemblance between them, from the points of view of their recent and ancient vertebrate fauna. These resemblances suggest the past existence of relations between these two lands now separated by a wide expanse of sea, and this agrees with geological observations.—*Translated for the Popular Science Monthly from La Nature.*

SKETCH OF FREDERICK C. SELOUS.

THE description of Selous, in Men and Women of the Time, as "explorer, naturalist, and sportsman," is suggestive of the manner in which his career has been developed and his fame has grown. Beginning his active life as a mere hunter of big game in the wilds of South Africa, and known at first only as a sportsman, he has become recognized as one of the leading, most intelligent, and most efficient explorers of his time, and is accepted as the most eminent authority respecting what relates to the large and important region of Mashonaland.

Frederick Courtenay Selous was born in London, the son of a father of Huguenot extraction and of a mother who, descended from the Bruces of Clackmannan, could count Robert Bruce among her ancestors, and was also related to Bruce, the Abyssinian traveler. He was taught at Bruce Castle, Tottenham, and then went to school at Rugby, where he distinguished himself by his activity, which was displayed in his high spirits and love of violent mischief and by his personal courage to such an extent that his schoolfellows wittily nicknamed him "Zealous."

Leaving Rugby when sixteen or seventeen years old, he spent two years in Switzerland and Germany, studying at Neufchâtel and Wiesbaden. His hardy activity seems to have been as marked in Germany as at Rugby, for it is recorded of him that he attracted some notice in the papers by jumping into the Rhine in winter after a wild duck which he had shot. He was not dressed for a swim, and, his great coat and top boots becoming filled with water, he had much difficulty in getting to shore with his game. His determination to achieve a career in South Africa by hunting and collecting specimens was apparently reached while he was still a youth, and at nineteen years of age he sailed from England, to land at Algoa Bay in 1871. Hunting was his object, as is substantially confessed in the title of his first book, A Hunter's Wanderings in Africa. The book won instant recognition as a story of

sport and a hunter's prowess, and was regarded in that light by the critics and the general public. The Royal Geographical Society, however, perceived other qualities in the story he had to tell, and gave him successively honorable mention, the Cuthbert Peake grant, and, in 1883, the Founder's Gold Medal, the highest honor it had to bestow.

Among the earliest testimonials paid by this society to the value, as yet not generally appreciated, of Selous's work was that given by Lord Aberdare, president, in his anniversary address, delivered in May, 1881, to the services rendered to geography in the regions west of Lake Nyassa by Mr. Selous, who had "hitherto been known as a mighty hunter of large game. . . . This gentleman, we learn, in 1878 penetrated for one hundred and fifty miles the unknown country north of the Zambezi, in the direction of Lake Bangweolo. He has since crossed in various directions the Matabele country south of the Zambezi, discovering two new rivers and defining the course of others which had previously been laid down from vague information." Selous's Notes on the Chobi, it appears, had already been published by the Geographical Society.

Mr. Selous has spent most of his time since he began his African wanderings in 1871, except for occasional visits to England, in traveling and hunting over that part of the African continent with which his name as an explorer is associated. In 1877 he and some companions penetrated into Matabeleland to hunt elephants. Relating the story of his wanderings in an address to the Royal Geographical Society in 1893, he described his experiences with fever and ague, the attacks of which began in Griqualand in 1872, but came on only when he halted anywhere a few days. North of the Zambezi he made several journeys among the Balongas, and spent a wretched rainy season, almost without equipment, on the Manica table-land, of the luxuriant vegetation of which, with sweet-smelling flowers after the rains, he gave a glowing description in his address. Interesting observations were made on some of the northern rivers. The curious phenomena of the steady rise of the waters of the Chobi and Machabi—an outlet of the Okavango—was observed from the first week in June till the last week in September, when the flood began to recede.

From 1882 the journeys acquired additional geographical importance, and Mr. Selous proceeded to rectify the maps of Mashonaland made by earlier travelers, taking constant compass bearings, sketching the courses of rivers, and fixing the positions of tributaries. The value of this work was made manifest in a magnificent large scale map of the country.

This map, which was published in 1895, was intended, first and

chiefly, to illustrate the work done by Mr. Selous while in the service of the South African Company; and, secondly, to embody, as far as possible, the knowledge possessed of the entire region extending from Fort Salisbury to the northward as far as the Zambezi, and to the eastward as far as the lower Pungwe. Mr. Selous's manuscript originals, deposited in the map room of the Royal Geographical Society, comprise a compass survey, showing the routes during a year's employment in the service of the British South African Company, September 1, 1890, to September, 1891, on a scale of 1 : 255,000; a sketch map, showing the route of the Manika Mission from Fort Charter to Umtassa's and thence to the camp near Mount Wedza, and also the routes taken by Mr. Selous from the camp near Mount Wedza to Makoni's, Mangwendi's, Maranka's, and back to Makoni's, on a scale of 1 : 255,000; a sketch of routes from Umtali to Mapanda (Pungwe) and back, in 1891, on the same scale; a sketch of Mashonaland, showing tribal boundaries, on the same scale; a rough survey map of the countries ruled over by the Makorikori chiefs, for which a mineral concession had been granted to the Selous Exploration Syndicate, on a scale of 1 : 210,000; and about thirty sheets of manuscript maps and rounds of angles, utilized in the compilation of the first four maps of this list.

Although Mr. Selous did not determine latitudes or longitudes, his long-distance compass bearings enabled him to lay down a network of triangles connecting Fort Salisbury with Masikesi. These triangles included Fort Charter, Sengedza, and Mavanka's in the south, Mount Mtemwa in the north, and Mount Dombo in the east; and it turns out that the distance between Fort Salisbury and Masikesi, as resulting from this triangulation, differs to the extent of only about a mile from that obtained by careful astronomical observations made at the two terminal points. The greater part of Mr. Selous's compass bearings were taken during the rainy season, when the air was very clear and landmarks could be seen at great distances. Mr Selous's determinations of altitude were not so accurate, and those obtained with the aneroid were characterized by himself as "of little value."

During all of his twenty years' wanderings Mr. Selous represented in his address to the Royal Geographical Society, with the exception of a treacherous night attack made upon his camp by the Mashuku-Sumbwe, led by a few hostile Marotse, in 1888, he had never had any serious trouble with the natives. He had gone among many tribes who had never previously seen a white man, and was always in their power, as he seldom had more than from five to ten native servants, none of whom were ever armed. Mr.

Selous's pioneer work began in 1889, when he conducted a gold-prospecting company through eastern Mashonaland. The journey took the party to the Portuguese settlements on the Zambezi, where those people were found to have a full appreciation of the richness of the gold region.

The British South Africa Company, or "Chartered Company," as it is sometimes called, was incorporated about the same time (October, 1889), with power to occupy and possess the large domains that constitute what is now called Rhodesia. The return of Mr. Selous to the Cape of Good Hope with the report of what he had observed had the effect of determining the company to speed its operations so as to anticipate the Portuguese. Mr. Selous entered the service of the company, and, although he was not yet an explorer in the scientific sense, the accurate memory of his early wanderings over the region enabled him to guide successfully the pioneer expedition that took possession of Mashonaland.

One of the sensational incidents of this campaign was the refusal of Lobengula to allow the pioneer force to use the road that led through Buluwayo, his capital, the only existing wagon road from the British frontier to the Mashonaland plateau. A new road was cut, under the guidance and superintendence of Mr. Selous, through four hundred and sixty miles of wilderness, the whole work being accomplished in two months and a half.

Among the chiefs who submitted to the British occupation after the seizure of Gonvola was Moloko, ruler of the country north of Manica, who made a treaty with Mr. Selous. After two years spent in various operations for opening up the country and securing treaties with the native chiefs, Mr. Selous returned to England in December, 1892, and put the narrative of his adventures to press, but was called back in August, 1893, returning at very short notice, on account of the threatening attitude of the Matabele chief Lobengula and the consequent risk of interruption in the development of the country. The tribes had risen against the assumption of the company to claim as a territorial cession what they had regarded as simply a grant of mining and exploiting privileges. Mr. Selous engaged actively in the campaign, in which he is credited with having fought with great gallantry by the side of the colonists, and was wounded while protecting some negroes who had been surprised by the enemy.

Returning again to Mashonaland, he reached there in time to witness a second outbreak of the natives, vexed by the triple plague of locusts, rinderpest, and the stringent regulations of the Chartered Company's government with respect to cattle. His own cattle were stolen, and he headed a company of volunteers that went

out to check the insurgents and protect the people who were still on their farms.

The fruits, in acquisition to geographical knowledge, of Mr. Selous's adventures and explorations are to be found, mingled with much about sporting and exciting incident, in his books: A Hunter's Wanderings in South Africa, already mentioned; Travel and Adventure in Southeast Africa (1893); Sunshine and Storm in Rhodesia (1896); and in lectures to the Geographical Society and periodical contributions concerning Mashonaland.

These books abound in observations on natural history, often constituting real contributions of new facts or new demonstrations to the science, usually occurring incidentally in the narrative of adventure, but sometimes given in more formal shape. The author avows that his conclusions respecting animals are drawn from personal experience of the beasts, and are not influenced in any way by the stories of old hunters, Dutch or native. Among these notices are original observations on the giraffe and its habits, notes on buffaloes and their disposition, and remarks on variations in the types of South African lions. Of this animal, while some authors would make three species, the author believes there is only one. "As out of fifty male lion skins," he says, "scarcely two will be found exactly alike in the color and length of the mane, I think it would be as reasonable to suppose there are twenty species as three." So in Notes upon South African Rhinoceroses, a paper read before the Zoölogical Society of London in June, 1881, and reprinted in this volume, Mr. Selous gives his reasons for affirming that there are only two species of rhinoceros in South or in all Africa—the square-mouthed or white *Rhinoceros simus* and the prehensile-lipped or black *Rhinoceros bicornis*—while the supposed *Rhinoceros keitloa*, or blue rhinoceros of the Boers, is merely a variety of the *bicornis*, the distinction between the two being based only on differences in the relative length of the horns. Another paper from the Proceedings of the Zoölogical Society, reprinted here, is Notes on the South Central African Antelopes, embodying again only the results of the author's own observations. In this paper twenty-two species are described by their scientific, native, Dutch, and English names, and their characteristics, habits, appearance, and distinctions are indicated.

In the preface to his Travel and Adventure in Southeast Africa Mr. Selous tells how he had determined, in 1881, upon visiting the ostrich farm of his friend Frank Mandy, to settle down in Africa for a quiet life. Then he went home and spent a few months in England. Visiting the Natural History Department of the British Museum, he was shown by Dr. Gunther and his associate how old

and dilapidated some of the specimens were, and how many noble forms were not represented at all. He took note of what he ought to get should he visit the interior of Africa again. Next we find him in South Africa, not quiet on a farm as he had intended to be, but in the wilderness, where he spent six years (1882–'87) engaged principally in collecting specimens " of the magnificent fauna which once abounded throughout the land," but many forms of which were now becoming scarce and some were verging on extinction. He shot and preserved a great many fine specimens of the larger antelopes, some of which may be seen in the New Natural History Museum at South Kensington, while others are in the collection of the South African Museum at Cape Town. Besides the stories of specimen hunting and adventures with the lions that are always to be found where game is abundant, the volume contains much matter of more general interest, such as notes of personal experiences among the Boers; accounts of two expeditions sent against the Batauweni by Lobengula; the devastations committed by the Matabele in Mashonaland; valuable notes on the Bushmen or Masarwas; accounts of journeys beyond the Zambezi to the countries of the Machukulumbwi and Barotsi tribes; and a review of the past history and present condition of Mashonaland. We find here also a notice of the caves of Sinola, with a subterranean lake in the principal cave having water marked by a deep-blue color like that of the blue grotto of Capri, an account of which was published by Mr. Selous in the Proceedings of the Geographical Society of London for May, 1888. An account of Mr. Selous's Twenty Years in Zambezia was published in the Geographical Journal in 1893.

Mr. Selous has done more than any other man to bring Mashonaland into notice, and is credited, together with Cecil Rhodes, with having contributed most to the creation of Rhodesia. The first comprehensive account of Mashonaland was given by him in the Fortnightly Review for May, 1889, when he described the country as a land of perennial streams in which thirst is an unknown quantity; with its high plateau, standing at an elevation of from four thousand to forty-six hundred feet and forming a very important watershed, endowed with a network of important streams, the springs supplying which, welling out from the highest parts of the downs, were capable of being applied to the irrigation of an enormous area, and having a salubrious climate, the continuous southwest wind giving cool breezes in summer and cold ones in winter. The high plateaus were further of much ethnological interest, in that they gave shelter to the very few remnants of the peaceful Mashonas who had escaped extermination at the hands of the Matabele.

Editor's Table.

SCIENCE AND THE SCIENTIFIC MIND.

THE address delivered by Prof. Michael Foster, as president this year of the British Association for the Advancement of Science, was not as long or elaborate as such addresses are wont to be, but it contained many thoughts of great value. After sketching the vast advances in scientific knowledge made within the present century, he observed, with great truth, that "the very story of the past which tells of the triumphs of science puts away all thoughts of vainglory." Why? In the first place, because no one can study the history of science without being made to feel how very near, in many cases, the men of the past came to anticipating some of the most famous discoveries and generalizations of later years. Translate the language of an earlier age into modern terms, and you often find that you have expressed the most advanced scientific doctrine of to-day. In the second place, if we find a certain lack of definiteness and truth to fact in the ideas of the past, how can we be at all sure how *our* ideas will look when confronted with the fuller knowledge which doubtless our successors will possess? Lastly, "there is written clearly on each page of the history of science the lesson that no scientific truth is born anew, coming by itself and of itself. Each new truth is always the offspring of something which has gone before, becoming in turn the parent of something coming after." However great the work of a man of science may be, "it is not wholly his own; it is in part the outcome of the work of men who have gone before." In this respect Professor Foster sees a striking difference between the man of science and the poet. We always know whence the former came, but the latter is almost as devoid of visible ancestry as Melchizedek. When the man of science dies the results which he achieved remain, and his work is taken up where he left it off; whereas the poet, strictly speaking, has no continuators. The Homeridæ do not represent Homer, nor do Dryden and Congreve take the place of Shakespeare.

The story of natural knowledge or science, we are reminded, is a story of continued progress. "There is in it not so much as a hint of falling back—not even of standing still." The enemies of science sometimes seek to turn against it the fact that each age revises the conclusions of the preceding one. They ask, What dependence can be placed upon opinions or theories that are thus subject to change? The answer is that the science of each age is the nearest approximation which that age can make to the truth, and upon some points represents the truth with a great approach to finality of interpretation. The law of gravitation, for example, as formulated by Newton, lies at the foundation of the physics of today. The circulation of the blood was discovered once for all by Harvey. The true theory of the solar system was given once for all by Kepler. It is the glory of science that whatever of imperfection may lurk in a scientific theory is sure to be brought to light and corrected by subsequent observation and analysis.

The learned professor dwelt briefly but forcibly upon the qualities of the scientific mind. In the

first place, the scientific mind must "vibrate in unison with that of which it is in search." It is in search of truth, and it must therefore vibrate in unison with truth. The follower of science must have a truthfulness beyond that of the ordinary man, who does not set a great price upon exactness in his observations or conclusions, and readily confounds things which, superficially similar, are fundamentally different. Nature resents even the most trifling inexactness, and the careless student will find that the further he carries his inquiries the further he goes astray. The scientific mind must also be alert. The indications and hints which Nature gives are sometimes very slight, and only one who is watchful in the extreme and attentive to the smallest things will catch them. Then the problems which Nature sets are often complicated, and call for a high degree of courage and perseverance. An inquiry which seemed easy at first will suddenly become overcast by what seems the most hopeless obscurity, and the scientific worker, unless he possesses the necessary moral as well as intellectual qualities, will fail in his quest. Considering the characteristics which the pursuit of science tends to develop in its votaries, and considering that scientific method is now and has been for many years past a wonderfully devised system for carrying on research, Professor Foster is surprised that the progress of science is not even more rapid than it is. He fears that perhaps Science does not get the best minds enrolled in her service, and rather hints that our institutions of education are responsible for turning aside many who might lend great aid in the advancement of real knowledge to less profitable pursuits. In words of almost precisely similar import to some that we used in these columns not very long ago, he observes that "that teaching is one-sided, and therefore misleading, which deals with the doings of man only and is silent about the works of Nature, in the sight of which he and his doings shrink almost to nothing." The whole address is stamped with the high thoughtfulness which so eminently distinguishes its author, and deserves to be carefully pondered by all who would understand the character and mission of science and the intellectual needs of the present age.

THE LATE WILLIAM H. APPLETON.

As many of our readers will have learned through the daily press, Mr. William H. Appleton, long the head of the well-known publishing house of D. Appleton and Company, passed away at his home in Riverdale on the Hudson, October 19, 1899, having reached the advanced age of eighty-five years. As one of the founders of this magazine, who from the start was in close sympathy with its aims, kept up an active interest in its management, and was ever ready to aid its conductors with advice and encouragement, it is fitting that a few memorial words should be spoken of him in these columns.

The career of Mr. Appleton was a marked one in many respects. Entering the book business of his father, Mr. Daniel Appleton, at an unusually early age, he soon developed such an aptitude for affairs that at twenty-one he went abroad for the purpose of making the acquaintance of the leading foreign publishers and paving the way for closer relations with them in the importation and sale of their books in this country. Three years later, or at the age of twenty-four, his father made him a partner in the business, which had previously been extended so as to include the publication as well as the sale of books, and had now so

increased in volume as to compel removal to more commodious quarters. Ten years of growth and uninterrupted prosperity followed, when Mr. Daniel Appleton, in 1848, retired from the now well-established firm, William H. Appleton, at the age of thirty-four, becoming its head, with his brothers John A. and Daniel Sidney as partners. In co-operation with these and other brothers who afterward entered the business, Mr. Appleton guided the operations of the firm for a period of nearly fifty years, successfully piloting it through several financial crises and carrying it to a foremost place among the publishing houses of America.

Besides the routine of an extensive publishing business, the history of the house during this time includes a number of large undertakings involving the expenditure of vast sums of money, and years of labor by many workers, and attended with risks that only the most far-seeing business sagacity could justify. We may presume that the several members of the firm shared a common faith in the success of these great enterprises, but it is fair to infer that as the head of the house William H. Appleton took a leading part in their origin and execution. One of these ventures was the publication of the American Cyclopædia, which in its present revised form represents an outlay of over a million dollars and some ten years of time. Another undertaking, and the one that we wish more particularly to speak of here, was the extension of the business in the line of popular scientific publications.

Scientific circles in this country have never realized the debt they owe to D. Appleton and Company, and especially to William H. Appleton, in this regard. It is no exaggeration to say that the advance of science in the United States was hastened by more than a quarter of a century by the enlightened and courageous policy which led the firm to add this class of books to their lists at the time they did. Everything apparently was against it—nothing in its favor. Our scientific literature consisted mainly of a few text-books having only a limited sale. Science itself was an affair of laboratories and bug collectors, the one to be shunned and the other commiserated. The few utterances of scientific men having a bearing on the great questions of the right interpretation of Nature, man's relations to his fellows and to the world at large, social betterment, etc., that here and there arrested public attention were received with contemptuous sneers or scouted as the rankest infidelity. Few who are not past middle life will find it possible now to realize that this was the general attitude toward science forty years ago, but we have only to refer the reader to the writings of the time for abundant confirmation of our statements.

It was such conditions as these that the firm was called upon to face when considering the question of entering this new field of publication. All ordinary business instincts were against it. Scarcely a publisher either here or abroad would even listen to the proposal to risk his capital in such an enterprise. Nevertheless, Mr. Appleton, lending an appreciative ear to the arguments of the former editor of this journal and displaying his usual foresight, finally decided in favor of the project, which afterward resulted in the introduction of the works of Spencer, Darwin, Huxley, Tyndall, Bain, Romanes, and other distinguished writers to American readers. A further step in the same direction, taken later, was the publication of the International Scientific Series, now numbering some eighty volumes. The scheme as originated and shaped by Professor

Youmans was heartily seconded by Mr. Appleton, as was also the plan of the Popular Science Monthly.

A distinctive feature of the arrangements for the issue of all these foreign books, and one which redounds in no small degree to the credit of the firm, was the voluntary agreement, in the absence of an international copyright law, to pay their authors the usual royalties, making no distinction between them and authors at home. Mr. Appleton had been a lifelong advocate of international copyright, founding his contention on the simple justice of recognizing the property rights of the author, no matter where he lived. Although to adopt such a course was to expose themselves to the possibility of heavy loss through the issue of reprints by irresponsible parties, a thing which actually happened in the case of a good many of the volumes, the principle was faithfully adhered to, thus anticipating by many years the central provision of our present law.

The storm of denunciation raised abroad by the appearance of the earlier installments of these writings might well have deterred the boldest from repeating the experiment of giving them currency in America. But in spite of solemn warnings that dire consequences would be visited on the publisher who ventured to issue them here, the books continued to appear, while the predicted evils never came to pass.

It must not be inferred from the foregoing, however, that Mr. Appleton was either unmindful or wanting in respect for the opposition which his course aroused. Much of this had its origin in the religious convictions of the community, not a little of the criticism, be it said, emanating directly from the Church or its leading representatives. But, being a strong churchman himself, actively furthering the work of the Church with his private means and personal co-operation, in full sympathy with its purposes, and rejoicing in its beneficent influence, he was the last one who would wantonly outrage the sacred beliefs of his fellow-men. Yet, gifted with a large-mindedness that is at least unusual in the walks of business, he was enabled to see that the onward march of natural knowledge which had so often before excited alarm among men of narrow views could have nothing in it that was inconsistent with a truly religious life; while, on the other hand, to promote its advance and diffusion was to contribute by so much to the highest human welfare.

The wisdom of Mr. Appleton's course has been fully justified by the event. As we look over the last half of the century, which has been so fruitful in discovery and has witnessed the development of so many agencies for the amelioration of human ills and so manifold an increase in man's power for right living, we can see at the various stages of this evolution how large a part the broadening of thought fostered by these authors and the new aims and methods in inquiry suggested by them have contributed to the advance. It could not, in short, have been made so rapidly or effectively without the stimulus they gave. For what has been done in this line in this country we think—when we reflect that it was he who had the courage to bring the works of those thinkers here, and who made them accessible to students and the reading public, who constituted the agency through which the new thoughts and aims were spread—a very important part in the achievement may fairly be ascribed to Mr. William H. Appleton.

Scientific Literature.

Owing to the increasing demands upon our space, authors and publishers are notified that hereafter the department of Scientific Literature, with the exception of Publications Received, will be discontinued.

SPECIAL BOOKS.

The busy pen of Mr. *John Fiske* has produced another book marked by the qualities which the public has learned to associate with all his work—lucidity of expression, felicity of illustration, a large command of the conventional elements of literary composition, and a philosophy which, while very free and lightsome in its steps and paces, always has the luck to fetch up within easy hailing distance of a moderate orthodoxy. Mr. Fiske undertakes to conduct us on an excursion *Through Nature to God*,* somewhat as Cook, of international fame, might undertake to see us safe from New York to the Holy Land. Of the two, we think Cook makes the surer thing of it; yet no one can deny that Mr. Fiske has done his best to trace the itinerary and encourage his excursionists to believe that they will "get there."

We may as well candidly confess that we have not much faith in the method followed in the work before us. The intention is to show that an analysis of Nature and of Nature's ways yields God; in other words, that we have only to carry out the processes of thought which an examination of the external world and of human history sets in motion in order to find God at the end of the argument. Thus, by searching, contrary to what Scripture has generally been held to imply, we find out both that God is and to some extent what he is. We prefer the older view. The world's greatest Teacher said simply, "God is a spirit." He did not say that this was a conclusion to which many lines of argument led. He did not hint at any kind of argument, but assumed the affirmation of God by the human consciousness. We venture to say that if Mr. Fiske's method were successful and we could argue ourselves into a belief in God, the result would be disastrous; for the God of argument, or even of analogy, is not the God of the human soul or conscience. We should have one conclusion more of science, but we should lose that for which no conclusion of science could make amends—our sense of the infinite and the possibility of faith.

Mr. Fiske discusses, in the early chapters of his book, The Mystery of Evil. He takes the familiar ground that evil is the necessary correlative, and in a manner the necessary condition, of good. We are placed in a universe that abounds in evil in order that by conquering it we may raise ourselves to a moral level otherwise impossible. On one page the author goes so far as to say that God, and not the devil, "is the creator of evil," but elsewhere he relaxes his boldness and speaks of evil being "permitted." One feels like asking, If good and evil are equally made by God, then which is which? When we speak of electricity as positive and negative we do not ascribe any superiority to one over the other. Nor do we say that centrifugal is a more commendable form of force than

* Through Nature to God. By John Fiske. Boston and New York: Houghton, Mifflin & Co.

centripetal, or *vice versa*. "For strong and resolute men and women," we are told, "an Eden would be but a fool's paradise." This is not complimentary to our first parents in their primitive condition of innocence, and it puts the curse pronounced upon them in a somewhat equivocal light. There is also quite a rehabilitation of the "serpent," who, it seems, knew quite well what he was talking about and gave excellent advice. We wonder whether Mr. Fiske is really of opinion that it helps us to solve any of the practical problems of life to be told that without evil there could not be good. Men have known for centuries that it is good to fight evil, though what evil is essentially they have often been in doubt. Upon the latter point Mr. Fiske does not in the least attempt to enlighten us; and yet it should be rather a more hopeful enterprise to attempt to show us what is specifically evil and ought therefore to be resisted, than to vindicate evil in general as the indispensable condition of good, and something, therefore, which God was justified in making.

The second division of the book deals with The Cosmic Roots of Love and Self-Sacrifice. We can not see that these roots are traced further back than the mother's affection for her offspring. Mother's love is doubtless an old story in the world by now, and perhaps as good a story as earth has to tell; but it seems to us that the "cosmic" character of it is not very apparent. We may believe that it was destined to come in the fullness of time, but this can be said equally of all that exists. "I think it can be shown," says Mr. Fiske, "that the principles of morality have their roots in the deepest foundations of the universe; that the cosmic process is ethical in the profoundest sense; that, in that far-off morning of the world when the stars sang together and the sons of God shouted for joy, the beauty of self-sacrifice and disinterested love formed the chief burden of the mighty theme." All we can say in regard to this is that Mr. Fiske has *not* shown it. He has shown just what we all knew before—that love exists in the world, that it antagonizes selfishness, and that human beings are endowed with a moral and religious sense—but he has not made it plain that the meaning of the universe is to be found in these (as we regard them) higher developments. He has himself acknowledged that, on a broad view of the world-wide struggle for life, there are no moral elements to be seen.

Religion, as we hold, is its own justification. There is more of religion in one verse of the Psalms than in all the Theodicies that ever were written. "As the hart panteth after the water brooks, so panteth my soul after thee, O God. My soul thirsteth for God, for the living God." Here is the whole essence of the matter—the affirmation of the human heart that there is something or some one beyond and above the mesh of circumstance and fact in which our lives are involved; something or some one who authenticates all that is good, and everlastingly condemns what is evil; something or some one to which or to whom the soul gravitates as to nothing else in the universe. When this affirmation is strong, religious life is strong; when it is weak, religious life is weak; should it cease entirely, then religion is dead. The book Mr. Fiske has given us is interesting from first to last—all his books are interesting—but it does not increase our knowledge, nor does it add to our knowledge faith.

GENERAL NOTICES.

The author of *Extemporaneous Oratory for Professional and Amateur Speakers** is himself one of the most effective orators, especially in debate, of the time. He has embodied in this book the results of ripened thought and successful experience gained in a field in which he is a master, for the instruction and help of those who would follow what he regards as the greatest of all arts, including the elements of all—music in the intonations of the voice, and painting and sculpture in the life, attitudes, and expression of the speaker. It is an art, too, which has wielded a more general and important influence than any other, which is almost universal in its appeals, and which any one may at any time find useful, when it will be of great advantage to him to possess the ability "to speak distinctly to the purpose, gracefully, with genuine fire." Extemporaneous oratory concerns the delivery, in form and language suggested by the occasion, "of ideas previously conceived and adopted with more or less fullness and precision, together with such thoughts and feelings as may arise and obtain utterance." It has many advantages over other methods of oratory, all tending to give the speaker greater power over his audience, and particularly in the fact that the extemporizer is at all times ready to expound, defend, illustrate, and enforce his opinions. The extemporaneous speaker must have a full and fluent command of language, and a full store of facts which he may at any time have to bring to bear upon the subject of his address and in the vindication of his opinions. The first place of importance is given to facts of natural science, which are of increasing utility. "To the educated and uneducated alike, natural science is now the most interesting of themes." Next come the facts of history and biography, those of the special branches bearing on the speaker's theme and purpose, and the great general conceptions included in the thoughts of the learned; and he must have settled opinions. At the basis of Dr. Buckley's treatment of this art and of his advice to those who would perfect themselves in it is the principle that extemporization is evolution after involution. This advice, in which the various phases of the subject are commented upon under a great variety of aspects, concerns the general preparation for the address, the acquisition of effective command of language, the exercise and training of the voice, the intellectual and physical elements that enter into oratory, its accessories, and the factor of the audience—all plainly and practically presented, with a facility of style that makes the reading of the book a pleasure.

* Extemporaneous Oratory for Professional and Amateur Speakers. By James M. Buckley. New York: Eaton & Mains. Pp. 480. Price, $1.50.

Readers of the Popular Science Monthly have already had an opportunity of perusing some of the narrative and observations which Professor *Heilprin* has embodied in his *Alaska and the Klondike*.* In it he has attempted to portray that remarkable region in its true aspects. Professor Heilprin is well able to do so, for he is a keen observer and looks with a scientific eye, and his literary style is free and graphic. He made a summer journey to the region last year (1898), between the end of July and the middle of October, with the object of being "able to determine between fact and fancy, and to obtain a personal knowledge of the region and its varied conditions." What he saw and heard is here presented. While by no means pretending to that degree of accuracy and of proper insight which can only come with more protracted and intimate knowledge, the author believes that he has given a careful and unprejudiced account. Persons whose ideas of the regions about Dawson are associated with visions of arctic severity and sterility may be a little surprised at reading of one's looking from

* Alaska and the Klondike. A Journey to the New Eldorado. Wi h Hints to the Traveler and Observations on the Physical History and Geology of the Gold Regions, the Conditions and Methods of working the Klondike Placers, and the Laws governing and regulating Mining in the Northwest Territory of Canada. By Angelo Heilprin. New York: D. Appleton and Company. Pp. 315. Price, $1.75.

the heights about the town northwestward "over a most lovely stretch of river, with hillsides closely besetting it, and with a vegetation of most striking brilliancy and vigor," and of the eye turned southward, losing, in consequence of the different configuration of the ground, "all but the beautiful verdant slopes which still mark out the valley"; of the beholder being able for hours at a time to sit watching the beauty of the landscape; and of the difficulty of recommending to one endowed with a proper appreciation for the works of quiet Nature "a more enjoyable exercise than to take in a bit of this wonderful land of the North, and with it a mellow sunshine that is not to be found elsewhere." These pretty landscape pictures of the arctic summer are followed by accounts of society at the Klondike as the author found it, of the trail, steamboat travel, and the routes to the region; a description of the placers, their occurrence, and the methods of mining; observations on the physical history and geology of the gold fields; and a summary of the laws regulating mining. In the summary of his geological discussion the author expresses the opinion that it seems probable that "the Klondike gold region is merely a fractional part of a discontinuously continuous auriferous tract that extends in a westerly course into the heart of Alaska, and southward into British Columbia."

Mr. *Bullen's Idylls of the Sea* * comprises three groups of essays, each group being marked by distinct characteristics. The sketches in the first group, the designation of which gives the name to the book, answer approximately well to Mr. Strachey's estimation of the whole as "some of the most vivid things ever written about the sea," such as only a man who really knows the sea in all its humors, and "has heard all those multitudinous voices that echo along the waste spaces of the deep," could write. There is something weird about them, and they have the air of mystery and superstitious awe with which, according to tradition, the sailor regards the imperfectly understood features of the sea. They are short stories of curious or striking incidents of sea life. The essays of the second group are real natural-history sketches—accounts of some oceanic birds, the kraken, sharks, the devilfish, etc., by a man who is well and scientifically acquainted with them. The third group includes longer sketches of seafarers' life, rather more actual ones than those of the first group, and papers having a critical bearing on the present conditions of British seamanship.

* Idylls of the Sea. By Frank T. Bullen. With an Introduction by J. St. Loe Strachey. New York: D. Appleton and Company. Price, $1.25.

The constant advance in the knowledge of dietetics makes it desirable that its results should be put in an accessible form, and this is particularly the case in regard to food for those in ill health, to whom it may be the means of restoring the normal condition. In her book on *Diet in Illness and Convalescence* * the author has endeavored to present the substance of Diet for the Sick, now out of print, together with recent thought on the subject, especially in the treatment of typhoid and malarial fevers, which we owe in such variety to the present war. An outline is given for suitable food in the more common forms of disease, suggestions for serving meals tastefully to an invalid, and numerous recipes for beverages, soups, dishes of meats, vegetables, and desserts. Some of these are taken from English and French treatises; others are contributions of American cooks, and include many novel and excellent ideas. From the preparation of koumiss and May wine to the manipulation of Dixie biscuit there is no want of explicitness, and one is tempted to covet the state of convalescence in which he could fare upon such attractive compounds as rose, violet, or amethyst jelly. A word of caution is inserted now and then. We are told "a fritter of any kind should never be mentioned in an invalid's book." Macaroni croquettes and soufflé of shad roe are, however, admissible. The beginning of the volume is devoted by the author to a brief consideration of the constituents of food and processes of digestion, with directions for the use of the pancreatic ferments. There are unfortunately many disputed points concerning a fit dietary

* Diet in Illness and Convalescence. By Alice Worthington Winthrop. New York: Harper & Brothers. Pp. 286.

in illness; not only idiosyncrasies of constitution but incomplete knowledge of physiological chemistry still render the problem difficult. New foods are constantly introduced which subsequent experiment proves to be harmful. The last dictum, we believe, in regard to saccharin is that it is not wholly innocuous, so that it might be as well for the diabetic patient to learn to do without sweets in the beginning, while as for the digestive ferments, they are at the least hazardous concoctions. We can not be too wary of artificial substitutes and laboratory products which claim the virtues of organic material or living protoplasm.

The reason for the being of *John Munro's The Story of the British Race* * is briefly indicated in the preface as to be found in the fact that the current ideas on the subject are derived from the views of historians representing the doctrines of an earlier and less critical generation, while the fact is overlooked that the new science of anthropology, using careful observations and exact methods, has put the real nature of the British people in a light in which it was never seen so clearly before. The result is that the old ideas on the subject have been greatly modified. Mr. Munro believes that his little book is the first attempt to bring these important results and views of modern anthropologists before the general public in familiar language, whereby the oversights of historians and teachers may be redeemed. An important error to be controverted, in the author's view, lies in the fine-drawn distinctions and sharply defined demarcations that have been made between Celts and Saxons. It is inferred from anthropology that the population of the British Isles is a mixture of all the races of western Europe, in which the Teutonic and Mediterranean elements—"the aborigines of Europe"—predominate, while "the intrusive Celtic race from Asia," still represented by the Bretons, passed into the British Isles in comparatively small numbers. Scotland is perhaps more Teutonic and less Mediterranean than England, Wales, or Ireland. Wales is the least Teutonic and the most Mediterranean, if not Celtic, of the three. England has more of the Dutch and Low Country elements than of the Scandinavian, with apparently not far short of an equal share of the Mediterranean and Teutonic elements. Ireland is perhaps as Teutonic as England, though the better fusion of the elements may disguise the fact. The author thinks that the first chapters of English history will have to be written over again by the light of anthropology.

The *Eighteenth Annual Report of the United States Geological Survey* * mentions, as an important change in the field work that made necessary by the legislation providing for the establishment of levels and permanent monuments and bench marks, of which 10,840 miles of levels were run and 1,820 bench marks were established. The topographic surveys to date covered an aggregate area of 759,525 square miles, of which 240,000 square miles were on a scale of four miles to the inch. The topographic work has progressed very satisfactorily under the present organization of the survey, including, in the year covered by the report, surveys in the Indian Territory and of the northern part of the boundary line between Idaho and Montana—the first work of the kind assigned to the Geological Survey—and the beginning of the survey of the forest reserves. The work on the educational series of rocks has been completed. It includes two hundred and fifty larger and smaller sets, which will be distributed to institutions where geology is taught. In his general report the director mentions the work of more than thirty geological parties in all parts of the United States, of six paleontological parties, hydrographic and topographic surveys by States, and the work of the division of mineral resources, the full account of which will constitute Part V of the report. The theoretic and other papers in Part II relate to the Triassic

* The Story of the British Race. (Library of Useful Stories.) By John Munro. New York: D. Appleton and Company. Pp. 228. Price, 40 cents.

* Eighteenth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1896–'97. Charles D. Walcott, Director. In Five Parts. Director's Report, including Triangulation and Spirit Leveling. Pp. 450, with 4 plates. Part II; Papers chiefly of a Theoretic Nature. Pp. 653, with 105 plates. Part III; Economic Geology. Pp. 861, with 118 plates. Part IV; Hydrography. Pp. 756, with 102 plates.

Formation of Connecticut (W. M. Davis), Geology of the Edwards Plateau, etc., Texas (R. T. Hill and J. W. Vaughan), North American Tertiary Horizons (W. H. Dall), Glaciers of Mount Rainier (I. C. Russell) and Rocks of Mount Rainier (G. O. Smith), The Franklin White Limestone of New Jersey (J. E. Wolfe and A. H. Brooks), the Geology of San Clemente Island (W. S. T. Smith), Geology of the Cape Cod District (N. H. Shaler), and Recent Earth Movement in the Great Lakes Region (G. K. Gilbert). Part III contains papers on the gold districts of Alaska, by G. F. Becker, J. E. Spurr, and H. B. Goodrich; Coal Fields of Puget Sound (B. Willis), the Judith Mountains of Montana (W. H. Weed and L. V. Pirsson), Certain Mining Districts in Idaho (W. Lindgren and F. H. Knowlton), and the Mining Districts of the Telluride Quadrangle, Colorado (C. W. Purington). The four papers in Part IV are a Report of Progress of Stream Measurements during 1896, by A. P. Davis; the Water Resources of Indiana and Ohio, by Frank Leverett; New Developments in Well-boring in South Dakota, by N. H. Darton; and Water Storage and the Construction of Dams, by J. D. Schuyler.

The purpose of *Belle S. Cragin's Our Insect Friends and Foes* * is illustrated from a passage in the author's own life, cited in the preface: "In my younger days, when Nature study was unknown in schools and my problems had to be solved by my own investigations or remain unsolved, I used to long for somebody to write a book that would tell me the things I wished to know, or show me how to find them out for myself; and that is what I have tried to do for you." The beginning of the book is a chapter on the collection, preservation, and care of insects for specimens, giving explicit directions for collecting them perfect, for putting them to death, for mounting and placing them in the cabinet, and for protecting them against vermin, dust, and mold, with descriptions of the instruments, cases, etc., that are used. In the descriptions of insects no attempt is made to mention any except the commonest species, and not all of those. The habitat, in most cases, is included in the description. As a rule, most of the species are those found in the States east of the Rocky Mountains and north of the Gulf States. Scientific names are attached to the illustrations and a list of popular names, with their scientific equivalents. The descriptions are brief and well adapted to the purpose indicated in the quotation with which our notice begins.

* Our Insect Friends and Foes. How to Collect, Preserve, and Study them. By Belle S. Cragin. New York: G. P. Putnam's Sons. Pp. 377. Price, $1.75.

In presenting a revision of their *Plane and Solid Geometry* * Messrs. *Beman* and *Smith* express their belief as being, that amid all the schemes for breaking away from the formal proofs of Euclid and Legendre and leading the student to independent discovery, the best results are secured by setting forth a minimum of formal proofs as models, and a maximum of unsolved or unproved propositions as exercises. They likewise share in the belief that such of the notions of modern geometry as materially simplify the ancient should find place in our elementary text-books. Accordingly, they have introduced various ideas, such as those of one-to-one correspondence, anti-parallels, negative magnitudes, general figures, prismatic space, similarity of point systems, etc., which are of real use in the early study of the science. In general, whatever is found to be usable in elementary work has been inserted where it will prove of most value.

The plan of the investigation undertaken by Mr. *Walter Smith* in his *Methods of Knowledge* † is, first, to give a definition of knowledge. The methods are then considered by which men have thought it possible to attain knowledge of the self on the one hand, and the not-self on the other. The common view of philosophers and men of science that truth is given in general concepts, or universals, or categories, is taken up, and the special form of the doctrine given in empiricism is considered and found to be a doctrine wanting in all its forms. Yet it is pointed out that

* New Plane and Solid Geometry. By W. W. Beman and D. E. Smith. Boston: Ginn & Co. Pp. 382.

† Methods of Knowledge. An Essay in Epistemology. New York: The Macmillan Company. Pp. 340. Price, $1.25.

the concept has its uses in the mental economy. The method is then expounded of knowing the not-self as being gained by sympathetic imitation. It is then determined wherein self-knowledge consists, and the bearing of this theory on the philosophical problem and on certain practical questions is indicated.

In *The Philosophy of Memory and Other Essays* * Dr. *D. T. Smith* develops a theory of mental action, the basis of which is the setting up in the cells of the gray matter of the brain, and possibly of the spinal cord, of orderly grouping of waves or vibrations among certain atoms or molecules by whatever may affect any of the senses; that these undulations are realized first as sensations, and then group themselves so as to form perceptions, ideas, emotions, etc. They rise in succession into the scope of consciousness. After a time the effect of these vibrations in consciousness is weakened, without perhaps utterly passing away, and retains the possibility of being re-enforced by kindred vibrations in harmony with it. This is memory.

In *The Psychology of Reasoning* † M. *Alfred Binet* makes reasoning a process of the formation of mental images. He finds no decided difference between perception—the cognizance of sensations and assignment of them to their source — and logical reasoning. "The two operations are both reasonings, transitions from the known to the unknown"; "the two extremes of a long series of phenomena." A premise is "a judgment, an association of images," and a conclusion that follows from the premises is "an association of images produced by other associations." The theory of three images—the two premises and the conclusion—"is applicable to reasonings of every kind, and therefore constitutes a general theory of reasoning. . . . If it be recollected that images are fragments, residues of former sensations; that they spring from the place where former sensations have been received, in the sensory centers of the cerebral surface layers, it will be understood that the purpose of these images in grouping themselves in reasonings, according to the laws of their affinity, is to replace the absent sensations. Such is therefore the function of reasoning; it enlarges the sphere of our sensibility, and extends it to all objects which our senses can not know directly. Thus understood, reasoning is a *supplementary sense*, which has the advantage of being free from those strict conditions of time and space—the two enemies of human knowledge." In memory, "the suggested image is projected and localized in the panorama of the past, of which it appears to be a fragment." Imagination is "a faculty of creating assemblages of images which do not correspond to any external reality."

The idea of preparing *Who's Who in America* * was suggested by the success of the English book, Who's Who? now in its fifty-second year, and the work has been prepared on similar lines. Its purpose is to supply information concerning living American men and women who have achieved distinction, who hold recognized public positions, and who have contributed so as to have it talked about to the growth, development, knowledge, and civilization of the country. Eight thousand six hundred and two such persons are represented in this book, including, *ex-officio*, all members of the Fifty-sixth Congress, Governors of States and Territories now in office, United States, State, and territorial judges of courts of high jurisdiction, persons of other prominent official classification, national academicians, members of the National Academy of Sciences, heads of the larger universities and colleges, and a few others chosen on similar arbitrary lines. Special effort has been made to include all living American authors of books of more than ephemeral value. The data for the book have been obtained from first hands, except in a very few cases, where the modesty of the subjects made it neces-

* The Philosophy of Memory and Other Essays. By D. T. Smith. Louisville, Ky.: John P. Morton & Co. Pp. 203.

† The Psychology of Reasoning. Based on Experimental Researches in Hypnotism. By Alfred Binet. Chicago: The Open Court Publishing Company. Pp. 191.

* Who's Who in America. A Biographical Dictionary of Living Men and Women in the United States, 1899–1900. Edited by John W. Leonard. Chicago: A. N. Marquis & Co. Pp. 822.

sary to supply the material from other sources, when the articles were submitted to the subjects for revision.

In *The Dawn of Reason** Dr. *Weir* has provided a most interesting book for the unscientific reader as well as for the comparative psychologist. He traces the gradual unfolding of conscious mind in animal life from the actinophryans which discriminates between the grains of starch and sand, and the Stentor which changes its position to catch a ripened spore, to the higher forms that decorate their homes, exhibit parental affection, exercise mathematical faculty, and extricate themselves from unforeseen dangers. As the field of observation of the senses of touch, taste, and smell has been so thoroughly worked by Lubbock and other naturalists, special attention is paid by the author to the senses of sight and hearing, in regard to which he furnishes new and valuable data. In addition to these he claims to establish the fact that tinctumutations and "homing" are auxiliary senses—not instincts. He located the center of color changing in the frog exactly below the optic, and by artificial stimulation produced the alteration in tint, and by excision, or treatment with atropine, destroyed the chromatophoric function. By experimentation upon snails he found the center of the sense of locality at the base of the cephalic ganglion, and, removing it, rendered them unable to return to their homes. Many anecdotes are given showing that the lower orders of animal life exercise conscious determination, and that among those with more complex nervous systems there is a mind akin to that of man. Not only do animals remember friends, strangers, and events, but they love, hate, and fear. They evince æsthetic feeling also when the spider ornaments its web with logwood flakes, the dog howls in harmonic accord with the church bell, and salamanders assemble at the sound of a piccolo. Still higher psychical attributes are those of animals that show parental affection or ability to count, like the mason wasp, which provides invariably five spiders for the male larva and eight for the female; or the harvester ants that plant their grain, weed and winnow it. Examples are cited of the capacity of the elephant to form abstract ideas and of the dog to indulge in brown studies. The author scouts at the theory that "specialized instinct," or "intelligent accident," prompts actions in animals which in man would be ascribed to reason. "Instinct," he writes, "is the bugbear of psychologists," and thereupon he differentiates sharply the two sadly confused functions.

* The Dawn of Reason. By James Weir, Jr., M. D. New York: The Macmillan Company. Pp. 234. Price, $1.25.

In the thesis entitled *A Step Forward*, *F. Theodor Kruger* proposes, as a measure of possible social reform, placing the medical and legal professions wholly under the direct control of the civil authorities, to be exercised through duly constituted boards or departments of the several communities.

In his study of *Centralized Administration of Liquor Laws in the American Commonwealths* (Columbia University Studies in History, Economics, and Public Law) *Clement M. L. Sites* finds that widely variant policies are followed by the several States in the regulation of the liquor traffic, all based upon the broad powers of taxation and police. While we hear much of characteristic plans of regulation, little is said about characteristic systems of administration. This is because the liquor laws are administered incoherently. There is no consensus, even within the Commonwealth, in standards of administration. Each community practically determines for itself how the law shall be enforced, and we have all degrees of enforcement, from rigid severity to none. The various plans of regulation are classified by the author according to the dominant aspect in which they regard the liquor traffic. It has been treated as an open traffic, subject simply to taxation and reasonable safeguards; as a necessary but dangerous business, to be limited to approved persons and places and surrounded by special safeguards; as a criminal enterprise, to be suppressed, like highway robbery; and as a subject of legal monopoly. It is the purpose of Mr. Sites's essay to follow the developments of centralized administration that have taken place in recent years in each of these spheres, and in that of the institution and maintenance of judicial proceedings. The phases of current de-

velopment that seem to merit special note are the substitution of the liquor-tax system for the license system, the extension and elaboration of local option, the contingent central control of city police administration, and the recognition of the general province of administration. The author's study shows that these developments accord in general with the laws of evolution, each representing some special aspect of the differentiation. In considering the "dispensary" plan, illustrated in South Carolina, a significant contribution to current thought is remarked in the approval it gives to the use of liquors as a beverage, while their abuse is disapproved in an equally marked degree, a distinction being attempted here, with correspondingly different methods of treatment between those who can be trusted with liquors and those who can not.

The Report of the United States Commissioner of Fish and Fisheries for the year ending June 30, 1898, represents that the operations of the division of fish culture were in some respects more important during that than in any preceding year. This was owing in part to the natural growth of the work, and in part to greater efficiency in dealing with the various questions and problems that came up for consideration. The propagation and distribution of food fishes exceeded by about forty per cent the work accomplished in any other twelve months. The steady increase in the catch of shad is cited as being conclusive evidence of the value of artificial propagation. The constant decline in the lobster fishery accentuates the necessity for increased work in that line. The efforts to acclimatize food fishes in waters to which they are not indigenous have been continued. The special papers published in connection with the report relate to mackerel investigations, the alewife fisheries, the oyster beds of Louisiana, the shad fisheries of the Atlantic coast, reports of fishes obtained in sea explorations, a list of publications, and a report of the exhibit at the Tennessee Centennial.

The Tenth Annual Report of the Interstate Commerce Commission on the Statistics of Railways in the United States covers the year ending June 30, 1897. The year is characterized as having been for the transportation industry one "of deferred expectations." While the years from 1890 to 1893 each closed with increased gross earnings as compared with the preceding year, 1893-'94 was disastrous, showing a large decrease; no recovery took place in 1894-'95, but an increase took place in 1895-'96. A downward turn came again in the year of the present report, with no revival till the last month of the twelve. The total increase in mileage for the year of the report was only 1,651.84 miles, the smallest increase and the smallest percentage of increase noted in any year since 1890. "In many States," says the report, "railway construction seems to have been practically abandoned. Especially is this noticeable in the more populous districts of the country—a result which is not entirely due to the general commercial depression, but to the marvelous increase in electric railways for suburban and short-distance traffic. The influence of electric construction upon steam transportation is noted in certain of the reports of State railway commissions for the current year." These are only two of the numerous interesting facts presented in the report.

Small Accumulators, how Made and Used, is the first of a series of popular scientific handbooks for students and engineers. The particular subject has been selected for beginning the series under the suggestion of a large number of requests for advice which the author, *Percival Marshall*, had received in his capacity as editor of the Model Engineer and Amateur Electrician. The work is intended to be an elementary handbook—"a practical and trustworthy guide"—for amateurs and students. The theory of the accumulator is explained, directions are given for making them, types of small accumulators are illustrated, the charging and use of accumulators are explained, and the applications are shown. Useful receipts and a glossary of technical terms are given. (The book is published by Spon & Chamberlain, New York. Price, 50 cents.)

In his *Better World Philosophy—a Sociological Synthesis* (Chicago: the Ward Waugh Company), *J. Howard*

Moore utters a protest against the egoism or selfishness of our day, and suggests an ideal scheme. The problem of life is defined as being the relation of each individual to the rest of the universe, and is peculiarized by the existence of the social problem involving relations of individuals to each other different from those sustained to the impersonal universe. There are in the nature of living beings the egoistic element, which impels action in behalf of self, and the altruistic element, which prompts or prevents movement out of consideration to others. At present the egoistic element predominates, with results that make a picture far from bright. In the social ideal the strong should supplement the weak as they would like to be supplemented if they were weak; individuals not unequal but diverse may mutualize their efforts to the advantage of all; and each individual should perform in the social economy that function for which he is best fitted, and should receive in return "a graceful equity in the means for satisfying his desires."

Among the books announced for issue soon by Henry Holt & Co. are *The Book of Vertebrate Zoölogy*, by Prof. *J. S. Kingsley*, author of The Elements of Comparative Zoölogy, published by the same house, which can be used as a companion to McMurrich's Invertebrate Zoölogy; *Elementary Studies in Chemistry*, by Prof. *Joseph Torrey*, of Harvard, which, while it is characterized by the emphasis laid upon quantitative laboratory work in general chemistry, will be a comprehensive textbook on the whole subject; and *Moulds, Mildews, and Mushrooms*, a guide to the systematic study of the fungi and *Mycetozoa* and their literature, by Prof. *Lucien Underwood*, of Columbia University.

Miss Cornelia E. Horsford, being interested in the question of the origin of certain ancient ruins situated on the Charles River, Mass., and elsewhere in America, which were discovered by the late Prof. E. N. Horsford and were believed by him to be relics of the settlements formed by the Norsemen in the tenth century, commissioned Mr. Thorstein Erlingsson to examine for comparison certain ancient dwellings in Iceland, in the summer of 1895. The inquiries assigned to him related to the method of construction of the long houses, square buildings, hillside cots with pavements, mounds, things and doom rings, irrigation and drainage, ditches, river dams, hithes and ship docks, or *nauts*, grave-hills, and forts. The results of the study are given, with illustrations, in a small book, *Ruins of the Saga Times*, by *Thorstein Erlingsson*. (Published by David Nutt, London.) Mr. Erlingsson's report is supplemented by an outline of already ascertained knowledge regarding early Scandinavian home building, derived from previous excavations and investigations furnished by F. T. Nørris and Jön Stefánsson, and a summary in French by M. E. D. Grand.

The Quarterly Journal of the Anthropological Institute of Great Britain and Ireland was issued during the thirty-seven years from the beginning of 1871 in the form styled demi-octavo. The small pages of this size entailed some inconveniences, especially when ample plates and tables were needed for illustration. With the double number (August and November, 1898) a new series was begun, in the form styled imperial octavo, with a page considerably larger than in the old form and corresponding in size with the important publications of some of the continental societies of Europe. This number contains the proceedings of seven meetings of the society and important anthropological articles, some of them on American subjects. Among them is a criticism, by Prof. W. Z. Ripley, on Deniker's Classification of the Races of Europe.

In *How to Swim* (Putnams, $1) Captain *Davis Dalton*, Chief Inspector of the United States Volunteer Life-Saving Corps, gives a practical treatise upon the art of natation, together with instruction as to the best methods of saving persons imperiled in the water and of resuscitating persons apparently drowned. The treatise covers every branch of the art, and abounds in cautions in connection with nearly every topic, against the mistakes that may arise from timidity or the carelessness of over-confidence. The author holds that swimming is an art to be acquired and learned like other athletic arts, al-

though it depends upon natural principles. The best movements for taking advantages of the physical laws involved in it have been studied by competent men, and a brief and clear presentation of them is attempted here. First, we have the lessons for the beginner, who must, before all things, "have confidence." The different strokes are described in detail and illustrated; the different modes of swimming and the postures, swimming in clothes, taking off clothes in the water, diving and swimming under water, swimming in waves, and other features are explained; and, finally, the life-saving directions are given, and public education in swimming is insisted upon.

The Southern Magazine is a new monthly, published at Manassas, Va., by the Southern Publishing Company, of which we have the third number, that for August. It has a definite flavor of the old South, for which we find no fault with, for there was much about the old South which ought to be preserved, and no little that was too precious to be lost. Among the matters of special interest in this number are the Sketch of Sidney Lanier, by Ellen Manderson, with selections from his writings; The Last Meeting of the Confederate Cabinet (held, by a curious coincidence, at Abbeville, S. C., where secession was started), by Walter L. Miller; an account of the University of Virginia, by John S. Patten, which appears to be the first of a series on Southern Educational Institutions; and an article on South Carolina in Letters, by Colonel J. P. Thomas.

The fifth yearly number of *L'Année Psychologique* of MM. *Alfred Binet, H. Beaunis*, and *Th. Ribot* is a volume of 902 pages, of which 591 pages are included in the first part, devoted to Original Memoirs and General Reviews. The papers are nineteen in number, on such subjects as muscular fatigue, the foreshortening of objects rising from the horizon, stereognostic perception and stereoagnosy, suggestibility, applications of the calculation of probabilities to psychology, colored audition, mental labor and nutritive changes, measure of mental fatigue, sensations of smell, phonographs and the study of the vowels, cephalometry, pedology, volume of the arm and muscular force, chronophotographie and other apparatus, and muscular sense; and the authors are MM. Van Biervliet, of Ghent; Blum, of Nîmes; Bourdon, of Rennes; Claparède, of Geneva; Clavière, Delage, Demeny, Druault, Mlle. Joteyko, MM. Larguier, Manouvrier, Marage; Marbe, of Würzburg; Obersteiner, of Vienna; Tschernig and Zwaardemaker, of Utrecht. M. V. Henri's paper on Muscular Sense would make a volume by itself. The second part—Analyses—consists of reviews of psychological publications entered under ten headings. The Bibliography contains 2,558 titles, and the index of authors fills upward of seventeen double-columned pages. (Paris: Scheicher Frères.)

Valuable papers on Comparative Tests of Bituminous Steam Coals, by John W. Hill; the Artificial Preservation of Railroad Ties by the Use of Zinc Chloride, by W. W. Curtis; and the Theory of Concrete, by G. W. Rafter, are given in the *Proceedings of the American Society of Civil Engineers* (vol. xxv, No. 4, April, 1899), together with discussions respecting street grades and cross-sections in asphalt and cement and to loads and maximum stress on members of a bridge truss; also biographical sketches of D. L. Barnes and W. R. Michie.

A valuable addition to D. Appleton and Company's International Education Series, and a sprightly book in itself withal, is *Montaigne on the Education of Children*, a volume of selections bearing on the subject from the writings of the quaint old Frenchman, translated and annotated by L. E. Rector. The significance of Montaigne, as the editor of the series observes in his preface to the volume, lies chiefly in his protest against pedantry, and the translator finds Montaigne's modernity shown in his attempt to degrade men learning from the first place, and to lay the emphasis on fitness for practical life, ability to use one's judgment, and morality and virtue. While Montaigne had limitations and defects in his educational views, such as are pointed out by Dr. Harris, he still appears to have been far in advance of his own time, and in some respects of the present time as well. The solution of the human

problem, success in dealing with one's self and his fellows, was his ideal. The translator shows how Locke and Rousseau, and, of course, all educational writers who have built upon these, drew from him. The subjects of the selections given here are the Education of Children, Pedantry, the Affection of Fathers, Liars, Physiognomy, Anger, the Art of Conversation, Idleness, Experience, and History.

An essay on *The Object of the Labor Movement*, by *Johann Jacoby*, translated by Florence Kelley, and published by the International Publishing Company, advocates co-operation, demands that the employer recognize the laborer whom he employs as a being fully his own equal and treat him accordingly, and claims of the State an especial consideration of the working class as an act of reparative justice.

The *Transactions of the First and Second Regular Meetings of the Wyoming State Medical Society*, May 13 and November 1, 1898, shows that that body is vigorous and active, and that the doctors of Wyoming are interested in maintaining the dignity and reputation of their profession. It is represented that fully fifty per cent of the regular physicians of the State have already been enrolled as members of the society.

Mr. *Frederick H. Gelman's Elements of Blowpipe Analysis* (New York: The Macmillan Company; 60 cents) is intended to serve the twofold purpose of giving the student a general outline of the analysis and of introducing him to the methods of determinative mineralogy. Every effort has been made to simplify the account. The first chapter is devoted to Apparatus and Details, and the second to the General Outline of Blowpipe Analysis. Then the general reactions for the detection of the metallic elements in simple compounds are described, the behavior of some of the principal ores before the blowpipe, and comparative tables.

PUBLICATIONS RECEIVED.

Abbot, A. C., M. D. The Hygiene of Transmissible Diseases, their Causation, Modes of Dissemination, and Methods of Prevention. Philadelphia: W. B. Saunders. Pp. 311. $2 net.

Allin, Arthur. Extra-Organic Evolution and Education. Pp. 8.

Baker, Charles Whiting. Monopolies and the People. Third edition, revised and enlarged. New York: G. P. Putnam's Sons. Pp. 368.

Baker, M. N. Potable Water and Methods of Detecting Impurities. New York: D. Van Nostrand Company. Pp. 97. 50 cents.

Baskett, James Newton. The Story of the Fishes. New York: D. Appleton and Company. (Appletons' Home-Reading Books.) Pp. 297.

Borodine, N., Editor. Revue Internationale de Pêche et de Pisciculture. (International Review of Fisheries and Fish-Culture.) No. 1. August, 1899. (Three times a year.) St. Petersburg, Russia. Published by the Russian Imperial Society of Fisheries and Fish-Culture. (In English, German, and French.) Pp. 37, with supplement of one folded page. Annual subscription, four francs.

Bulletin, Le, Médical de Quebec. Volume I, No. 1. September, 1899. Published under the direction of the Medical Society of Quebec. Monthly. Pp. 56. $2 a year.

Burgess, O. O., M. D. Consciousness, Being, Immortality; Divine Healing and Christian Science. San Francisco. Pp. 20.

Christian Science Publishing Society, Boston. Legal Aspects of Christian Science. Decisions of Courts, Opinions of Lawyers, etc. Pp. 83.

Conn, H. W. The Story of the Living Machine. New York: D. Appleton and Company. (Library of Useful Stories.) Pp. 191. 40 cents.

De Morgan, Augustus. Elementary Illustrations of the Differential and Integral Calculus. Chicago: The Open Court Publishing Company. Pp. 144. $1.

Descartes, René. Discourse on Method; or the Method of Rightly Conducting the Reason and Seeking Truth in the Sciences. Translated, etc., by John Veitch. Chicago: The Open Court Publishing Company. (Religion of Science Library.) Pp. 87. 25 cents.

Flynt, Josiah. Tramping with Tramps. Studies and Sketches of Vagabond Life. With Prefatory Note by Hon. Andrew D. White. New York: The Century Company. Pp. 396. $1.50.

Giles, William A., Chairman of the Legislative Committee of the Civic Federation (Chicago). Papers on Reform Legislation, Corrupt Practices Acts, and Pawnbroking in Different Countries. Chicago: R. R. Donnelley & Sons Company. Pp. 35.

Griffith, G. W. The Influence of the Earth upon the Field of a Bar Magnet. Pp. 4.

Harrington, Mark W. About the Weather. New York: D. Appleton and Company. (Appletons' Home-Reading Books.) Pp. 246.

Higginson, Thomas Wentworth. Contemporaries. Boston and New York: Houghton, Mifflin & Co. Pp. 379. $2.

Holland, Frederick May. Liberty in the Nineteenth Century. New York: G. P. Putnam's Sons. Pp. 257.

Korscheldt, Dr. E., and Helder, Dr. K. Text-Book of the Embryology of the Invertebrates. Translated by Matilda Bernard, and edited, with Additional Notes, by Martin F. Woodward. Vol. II. Pp. 369. $3. Vol. III. Pp. 441. $3.25.

Lake Mohonk Conference on International Arbitration. Report of the Fifth Annual Meeting, 1889. Pp. 142.

Lo Bianco, Dr. Salvatore. The Methods employed at the Naples Zoölogical Station for the Preservation of Marine Animals. Translated by E. O. Hovey. United States National Museum. Pp. 42.

Newman, George. Bacteria, especially as they are related to the Economy of Nature, to Industrial Processes, and to the Public Health. New York: G. P. Putnam's Sons. Pp. 348.

Newton, Alfred, Gadow, Hans, and others. A Dictionary of Birds. New York: The Macmillan Company. Pp. 1088. $5.

Ohio Agricultural Experiment Station. Press Bulletin No. 199. Plums. A Comparison of Varieties. Pp. 2.

Oliver, Charles A. Description of an Adjustable Bracket for the Reld Ophthalmometer. Pp. 3; A Case of Foreign Body in the Optic Nerve. Pp. 3; A Case of Reflex Irritation. Pp. 5; A Case of Fibroma of the Eyelid. P. 1, with plate; A New Method for the Plantation of Glass Balls into the Optical Cavity. Pp. 30.

Putnam, F. W. Address as Retiring President of the American Association for the Advancement of Science, Columbus Meeting, 1899. Pp. 17.

Ribot, Th. The Evolution of General Ideas. Chicago: The Open Court Publishing Company. Pp. 231. $1.25.

Russell, Charles T. The At-one-ment between God and Man. ("Millennial Dawn." Vol. V.) Allegheny, Pa.: Watch-Tower Bible and Tract Society. Pp. 507.

Stuver, E., M. D. The Importance of a Knowledge of the Phylogenetic Development of the Child in the Prevention of Children's Diseases. Pp. 11.

Thompson, Ernest Seton. The Trail of the Sandhill Stag. New York: Charles Scribner's Sons. Pp. 93. $1.50.

United States Department of Agriculture. Farmers' Bulletins. No. 70. The Principal Insect Enemies of the Grape. By C. L. Marlatt. Pp. 23; No. 80. The Peach-Twig Borer. By. C. L. Marlatt. Pp. 15; No. 99. Three Insect Enemies of Shade Trees. By L. O. Howard. Pp. 30; —Division of Entomology. No. 37. The Use of Hydrocyanic-Acid Gas for Fumigating Greenhouses and Small Frames. Pp. 10; No. 38. The Squash-Vine Borer. Pp. 6; No. 39. The Common Squash Bug. Pp. 5.

United States Fish Commission. Check-List of the Fishes of Florida. By B. W. Evermann and W. C. Kendall. Pp. 68.

Upsala, University of (Sweden). Bulletin of the Geological Institution. Hj. Sjögren, Editor. Vol. IV, Part I, No. 7. 1898. Pp. 131, with four plates.

Weed, Clarence Moores, Editor. The Insect World. A Reading Book of Entomology. New York: D. Appleton and Company. (Appletons' Home-Reading Books.) Pp. 207. 60 cents.

Wisconsin Geological and Natural History Survey. Bulletin No. 4. On the Building and Ornamental Stones of Wisconsin. By Ernest R. Buckley. Pp. 544.

Wisla. A Geographical and Ethnographical Publication (in Polish). Vol. XIII, Nos. 1 to 5. Warsaw, Poland. Pp. 320.

Wright, Mabel Osgood. Wabenor the Magician. New York: The Macmillan Company. Pp. 346.

Fragments of Science.

The Dread of the Jew.*—The Dreyfus affair and the furious passions that it has awakened have their ultimate foundation in dread and hatred of the Jews. There is a Jewish question, more or less acute, in every continental country, and we are told by pessimists that before long we shall have an anti-Jewish movement in the East End of London. These facts naturally suggest an inquiry into the causes of the dread and hate which the Jews inspire, and the asking once again whether there are any good grounds for regarding the Hebrew race as a menace to the Christian world. The main fact about the Jews on the Continent which emerges from a study of the present situation is that for some reason or other they inspire terror. That this terror is as absurd and as unreasonable as is the terror caused respectively by Jesuits and Freemasons, we ourselves do not doubt for a moment, but that does not alter the fact that the sense of terror exists. It is hardly too much to say that the majority of people on the Continent honestly believe that unless the Jews are in some way or other curbed, controlled, and kept down, something very dreadful will happen. In Russia the vast Slavonic population and its leaders believe that unless the Jews are impounded in the Polish Pale they will swamp the true Russian, and utterly ruin and destroy the Russian nationality and the

* From an article in the London Spectator.

Russian ideal. In Austria it is believed that if the Jews are allowed to go on as they are going on they will get everything into their hands—the land of the peasants, the sources of public information and the press, and the nerves by which trade and commerce are moved. In Germany it is much the same story, and there the Jews are believed, unless stopped in time, to be about to monopolize the universities. In France it is thought that the Jews, if not put down with the strong hand, will capture the whole administration, as well as "strangle commerce by their octopus grip." The Jews are called a "parasitic race," whatever that may mean. It is said that the Jew never becomes an agriculturist, that he is a usurer and a bloodsucker, that he is a gross materialist, and that he has no ideals beyond the precious metals; and that they habitually act together to further their own racial interests and to injure those communities which have been foolish enough to trust them. To take the charge of want of patriotism first. How is it substantiated? We can not say that we have ever seen any real evidence of want of patriotism in the Jews. Look at the case of France at present. There is something extremely pathetic in the way in which the French Jews cling to their nationality in spite of all the hatred they inspire. The truth is, the Jew is a sort of expert in patriotism. Did not the Maccabees teach the world one of its first lessons in patriotism? Depend upon it, if the Jew is only allowed to be a patriot he will not fail here. The charge, indeed, is like that so often made in Russia against the Jews. They are accused of not tilling the soil, their accusers ignoring the fact that no Jew is allowed to buy, or to lease, or to occupy land, and is, in fact, excluded by law from acting as a farmer. Take next the charge of "aloofness." Probably this charge is well founded, but what can be expected of a people so newly freed from the Ghetto? If you treat a race for centuries as lepers, and visit its members with dire penalties, if they do not keep "aloof" they are likely to remain for some time disinclined to free intercourse. The third charge is, in reality, that the Jews of the world, having obtained control of cosmopolitan finance, act together in the interests of their race, and inflict grievous injuries upon the nations. But what proof is there of this? Curiously enough, Mr. Arnold White—though in other ways he seems to encourage this charge—accuses the great Jewish financiers of not doing this very thing. He tells us that after the Russians had driven the Jews into the Pale they wanted to raise a loan. One would have expected the great Jewish loanmongers to have absolutely refused to help the enemy of the race. Instead they basely, as we think, found Russia the money she wanted. But though this was a base act, it certainly is not consistent with the charge that the Jews control the international money market for tribal ends. We believe, in fact, that this whole charge is a pure delusion. The great financiers, whether Jew or Gentile, look for a profit, and not to deep and mysterious racial aspirations. The charge that the Jews are steeped in materialism, and so are a demoralizing element in the community, is equally unfair and absurd. Many Jews may be fond of pomp of a vulgar kind, and may affect what we confess personally to finding very disagreeable forms of Asiatic luxury; but these are externals. In essentials and as a race the Jews are no more materialistic than their neighbors. And can we say that they are a demoralizing element when it is universally confessed that the Jews are among the best fathers, sons, and husbands in the world?

Death of Professor Bunsen.—With the death of Robert Wilhelm Bunsen, at Heidelberg, August 16th, the world loses a student whose name is inseparably connected with nearly all the chemical work that has been done in the last fifty years, for it is safe to say that hardly a discovery has been made or experiment performed to the success of which some process, property, or instrument discovered, invented, or suggested by Bunsen, and usually named after him, has not contributed. A sketch of this illustrious chemist, with a portrait, and an enumeration of his principal works, each of which might be characterized as a milestone in the advance of the science, was published in the Popular Science Monthly for August, 1881 (vol. xix, page 550). One of the prin-

cipal events in his life since that sketch was published was his election, in 1883, as one of the eight foreign associates of the French Academy of Sciences—the highest honor that that institution is competent to confer. Besides Bunsen's personal interest in the work and success of his students, one of his most salient traits, as described by a careful and appreciative biographer in the New York Evening Post, was his absent-mindedness concerning what he had himself accomplished. He was afflicted with an "incipient aphasia," which made it impossible for him to talk about them. "He could not answer verbal questions, whether oral or written. He could not have passed a decent examination in his own discoveries. Let the question come in the shape of an emergency in a chemical operation, and a wealth of knowledge would be poured out, but let it be put in words and he could not answer it." He is said to have answered a student once, who asked him about some substance, that he knew nothing about it—"You will have to look up the literature." The student looked up the literature, and found that it consisted of a single article, and that by Bunsen! Professor Bunsen prized what would stimulate him to effort, enjoyed life, was fond of travel and interested in everything human, and was a good novel reader.

The Unprofitableness of Strikes.—The cost of a large strike is impressively illustrated in some of the results of the great colliery dispute of 1898 in South Wales, as they are set forth in the British Board of Trade returns and the reports of the consular service. In direct financial loss, the company suffered to the extent of $100,000, and the men of $300,000 in wages, besides the demoralization from being so long out of work. To a certain extent, other districts gained what the South Wales mines lost by the diversion of trade to them, but that simply aggravated the evil in the mines, for some of this diverted trade will stay where it went. It is sometimes said, indeed, that strikes have only a temporary effect on business, from which it will recover in time. This is true, however, as is suggested in Industries and Iron, only when the locality affected has a virtual monopoly of the trade, while in the competition of the nations instances of that kind are growing rarer. England especially has many rivals in these days, eager to take advantage of every opportunity to profit by its mistakes or misfortunes, and which, when they get their hands on a good thing, are not apt to let go. Notwithstanding some strikes at home, the coal trade in the United States derived benefits from the British strike by sending to markets which the Welsh mines should have supplied; Germany sent coal to Sweden, and Belgium increased its shipments to the Canary Islands. Other countries are induced, by conditions making the usual sources of supply inconvenient to them, to a more active development of their own resources, as Austria-Hungary, Spain, and France were in the present case. So it is more than doubtful whether the present strike paid.

The Scientific Spirit.—The study of science, especially of an experimental science, said Prof. R. H. Chittenden in an informal talk to students of the Sheffield Scientific School, is peculiarly adapted for developing the power of independent thought, and of training one in drawing logical conclusions from experimental data. In the laboratory is afforded an opportunity for making observations, but if real benefit is to be derived from the experimental work there must be a full realization of the necessity of careful thought in drawing deductions from the results observed. Broad generalizations built on a slender foundation of fact frequently topple to the ground, and sometimes carry destruction with them, all because of a lack of that critical spirit which prompts a careful and thorough consideration of all the premises. The man who has acquired the habit of careful thought, of reasoning out each step in a process, of weighing carefully each reaction involved, of seeking in his own mind the reason for this or that phenomenon, who looks at both sides of a question, and carefully considers all the facts available, will build much more surely and firmly than he who by specious arguments constructs a glittering hypothesis, only to see it fade away. Hasty reasoning, insufficient data, obscure facts, are the bane of modern sci-

ence. The true scientific spirit prompts to thorough inquiry; it will have nothing to do with hasty generalizations that may glitter but do not convince; it puts a restraining hand on all immature conclusions, and demands, above all else, careful, thorough observation. It shuns all shams. Good, honest work is the only passport to the domain of science.

Constitution of the Funafuti Atoll.—In the boring of the coral atoll of Funafuti, Professor David, of the University of Sydney, reached a depth of 697 feet, and a subsequent boring was made down to about 1,000 feet. The core obtained by the David party was sent to England and placed in the hands of Professor Judd for investigation. The general statement is made respecting it that the material brought up presents much the same character throughout, and so far is regarded as supporting Darwin's theory. There are no layers of chalky ooze, such as Murray's hypothesis might have made possible, and no trace of volcanic material has been found. The later boring beyond 700 feet passed through a hard limestone containing many well-preserved corals. In a boring of the bed of the lagoon down to 144 feet, after passing through 101 feet of water, the first 80 feet below were found to consist of the calcareous alga Halimeda mixed with shells, and the remaining 64 feet of the same material mixed with gravel.

Metallic Calcium. — Metallic calcium, as prepared by Professor Moissan from solution in liquid sodium, separates in hexagonal crystals which have a specific gravity of 1.85 and melt at 760° *in vacuo*. On solidifying, the metal is somewhat brittle, is less malleable than potassium and sodium, and shows a crystalline fracture. When free from nitride it is silver-white in color, and has a brilliant surface. Heated to redness in a current of hydrogen, a crystalline hydride, CaH_2, is formed. When pure, calcium is not acted upon at ordinary temperatures by chlorine, though at 100° C. the action is decided. But if the metal contains nitride, chlorine attacks it at the ordinary temperature. At 300° C. calcium ignites and burns brilliantly in oxygen. Gently warmed in air, it burns with brilliant scintillations. It combines with sulphur, with incandescence, at 400° C. At a red heat it unites actively with lampblack, giving a carbide, CaC_2. It gives some brittle alloys with magnesium, zinc, and nickel. The alloy with tin slowly decomposes water. A crystalline amalgam is formed with mercury, which may be distilled in hydrogen at 400° C., but which forms nitride when heated in nitrogen. Heated to redness with potassium or sodium chloride, calcium sets the metal free. Water acts on calcium only very slowly, with the evolution of hydrogen. In liquefied ammonia at $-40°$ C. calcium ammonia is formed—a reddish-brown solid.

Prosperity and Enterprise in Mexico.—The increasing prosperity of Mexico is one of the striking features of current history. In four years the imports of the country increased from $30,000,000 in 1894 to upward of $45,000,000 in 1898, the average for five years having been $40,000,000. The chief sellers to Mexicans are the United States, Great Britain, France, and Germany, and the keenness of the competition for trade is shown in the fluctuations in the relative shares of it of the several countries. Spain has a small share of trade, which is growing. Industrial enterprises are being developed throughout the country with energy, enterprise, and success. Cotton and linen factories have been established, attention is given to the erection of woolen mills, and a noticeable activity prevails in mining industries. Under all these influences the railroads are prospering too.

A Question of Economy.—A paper, "Shall we grow the Sugar that we consume?" by Freeman Stewart, called out by an article by ex-Secretary Wilson, besides matter bearing directly on the question, embodies observations on general political principles. Thus, it seems necessary to observe "that the idea that republicanism requires our public officials to act as mere weathercocks for the transient waves of popular clamor and excitement is also a deplorable delusion, which, if persistently carried into effect, will soon utterly destroy republicanism. As free institutions depend on

the recognition of correct principles by the people, it is primarily necessary that correct principles should be constantly impressed upon the attention of the people. The great need of the nation today is wise leadership—unselfish men, who appreciate the necessity of being governed by immutable divinely appointed principles, to act as leaders, to keep the minds of the people centered in the right direction." Coming to the main subject of the essay, we have, as to the expediency of taxing ourselves to have sugar made here: "If the farmer's profits must come from the consumers of sugar as a bounty or tax, and not from the inherent profitableness of the business, then the farmer's profits are the consumer's loss. The business is inherently unprofitable, and no farmer, or any one else, has a right, 'inherent' or otherwise, to carry on an unprofitable business, except at his own expense. . . . It may be assumed that the farmers who are growing the sugar are now growing crops which, if not as profitable as they desire, are at least sufficiently so to keep them from being burdensome to the rest of the nation. And how can the prosperity of the nation be increased by having these same farmers engage in a new business which will require them to draw on the productive capacity of the rest of the people to the extent of many millions of dollars annually, in order to keep their heads above water?"

Bacteria of the Dairy.—An investigation of the relation of acid fermentation to the flavor and aroma of butter, made by C. H. Eckles at the Iowa College Experiment Station, has given the results that the flavor is produced by the bacterial fermentations which have taken place in the milk and cream. The kind of flavor depends upon the class of bacteria causing the fermentation. The ripening of a good quality of acid cream is mostly a development of acid bacteria. Four species of acid-producing bacteria, tested in ripening pasteurized cream, were found to give the butter the typical flavor and aroma. Of the species tried, the most common milk-souring organism (*Bacterium lactarii*) was found to give the most satisfactory results in ripening cream. Cream ripened with common bacteria found in hay dust (*Bacillus subtilis*) gives a very undesirable flavor to butter. The superior flavor of summer butter is due to the greater number of bacteria of the acid class found in milk during that season.

For Outdoor Improvement.—The American Park and Outdoor Association has taken up and aims to rationalize the important work of the improvement of outdoors. Not that it expects to improve upon Nature, but it hopes to be able to neutralize or remedy the devastation and disfigurement which man has wrought upon her face. At the third annual meeting of the association, held in Detroit in July, 1899, preliminary steps were taken toward offering prizes for the improvement of grounds about manufactories and homes—both front and back lots—and especially about the homes of artisans. A standing committee was instituted to consider the best way of checking abuses of public advertising. A paper read by Mr. F. Law Olmstead, on the Relation of Reservoirs to Public Parks, concerned such construction of reservoirs and the surrounding them with suitable settings as would bring them into closer harmony with the park landscape and make them more a part of it. Another paper, by Mr. R. J. Coryell, of the Detroit parks, might be described as an effort to show how a similar service may be performed for the parks and the people—in other words, how to make the people at home in the parks. Its points were illustrated by citing what had been done in Detroit. Respecting means of preventing depredations, Mr. C. C. Lancey told of good results accomplished in Rochester, N. Y., by the distribution of circulars of information on the subject; and Mr. F. L. Olmstead, Jr., of the interest taken by the children in the school gardens in Cambridge, Mass.

Where Physical Investigation Fails.—From the discussion of the physical method, with its descriptive laws and applications and hypotheses, Prof. J. H. Poynting was led, in his address at the British Association, to the consideration of the limitation of its range. It was developed in the study of matter which we describe as non-living, and with non-living matter it

has sufficed for the particular purposes of the physicist. Of course, only a little corner of the universe has been explored, but in the study of non-living matter we have come to no impassable gulfs, no chasms across which we can not throw bridges of hypothesis. Does the method equally suffice when it is applied to living matter? Can we give a purely physical account of such matter? Do we make any attempt to apply the physical method to describe and explain those motions of matter which on the psychical view we term voluntary? In practice the strictest physicist abandons the physical view, and replaces it by the psychical. He admits the study of purpose as well as the study of motion, and has to confess that here the physical method of prediction fails.

Honors to Sullivant and Lesquereux.—"Sullivant day," August 22d, was devoted in the American Association to the commemoration of the lives and works of William S. Sullivant and C. Leo Lesquereux, botanists, the former distinguished for his studies in the mosses and the latter for his researches in paleobotany, both of whom lived and did the work by which they became famous in Columbus, Ohio. Sullivant was born and passed the whole of his life in Columbus. Lesquereux, a Swiss by birth, lived in Columbus during many of his most fruitful years, and worked alongside of Sullivant. A considerable number of objects associated with the two botanists were on exhibition—rare botanical specimens, charts and pictures connected with their labors, and complete sets of their published works—and excellent and highly prized portraits of them were shown. The families of both were represented by the presence of daughters and granddaughters, among whom was Miss Arhart, a granddaughter of Lesquereux, who was associated with him in part of his work, and made most of the drawings for his later books. Prof. C. R. Barnes presided over the exercises. Prof. W. A. Kellerman read a tribute to Sullivant from Dr. Gray's supplement to the Icones. Mrs. Britton gave a short review of the species named from Sullivant (including twelve North American mosses). Professor Barnes read a tribute to Lesquereux, taken from the Botanical Gazette. Remarks were made and papers read on the Progress in the study of the Hepatica, by Prof. L. M. Underwood; the Moss Flora of Alabama, by Dr. Charles Mohr (read by Professor Earle); the History of the Study of the Mosses, by Mrs. Britton; the Classification of Certain Mosses, by A. J. Grout; the Study of Lichen Distribution in the Mississippi Valley, by Bruce Fink; and Botanical Teaching in the Secondary Schools, by W. C. Stevens and Ida Clendenin. Among the exhibits, those of twelve species of hepaticæ from California, by Prof. F. E. Lloyd; forty-five photographs of American students and collectors made famous by their work in mosses, by Mrs. Britton and Professor Underwood; and six species of mosses discovered and collected originally by Sullivant and Lesquereux near Columbus, deserve special mention.

Rate of Evolutionary Variation in the Past.—Mr. Adam Sedgwick, speaking, in his address at the British Association, of variation, selection, and heredity, having raised the question whether the variability of organisms has ever been different from what it is now, answered it in the affirmative, because it would be absurd to suppose that organisms would remain constant in this respect while they have undergone alteration in all their other properties. According to the Darwinian theory of evolution, one of the most important factors in determining the modification of organisms has been natural selection. It acts by preserving certain favorable variations, and allowing others less favorable to be killed off in the struggle for existence. It will thus come about that certain variations will be gradually eliminated, while the variations of the selected organisms will themselves be submitted to selection, and certain of these will in their turn be eliminated. In this way a group of organisms becomes more and more closely adapted to the surroundings. It would thus appear that the result of continued selection is to diminish the variability of a species. Hence, as selection has been going on all the while, variation must have been much greater in past times than it is now. Following out this train of reasoning, we are

driven to the conclusion that one of the most important results of the evolutionary change has been the gradual increase and perfection of heredity as a function of organisms and a gradual elimination of variability. This view, if it can be established, is of the utmost importance to our theoretical conception of evolution, because it enables us to bring our requirements as to time within the limits granted by the physicists.

MINOR PARAGRAPHS.

Of the archæology of Block Island, Arthur Hollick found in his explorations that around the shores of Great Salt Pond and on the sand dunes that border the western shores of the island evidences of former occupation by the Indians are numerous. Kitchen middens are exposed in several street cuttings, implements are often found scattered over the surface of the ground in certain localities, and skeletons have been unearthed from time to time. In many places the kitchen midden accumulations were so obvious that it was impossible to ignore them entirely. They were found to consist of the customary collection of oyster and other shells, bones, pottery fragments, fire-cracked stones, charcoal, finished implements, rejects, flakes, chips, etc. The finished implements found were two axes, of a plagioclase igneous rock, and three arrow points, all of quartzite. In the sand dunes were many old fireplaces, mostly buried by the sand which has drifted over them. They could generally be located by the richness of the turf on the surface immediately above. Mixed with the accumulations in these places were the bones and teeth of animals. The island promises a good reward for archæological investigation.

In a form of disease known as peckiness in the cypress and pin-rot in the *librocedrus*, described by Hermann von Schrenk in a thesis presented to Washington University, the wood is destroyed in localized areas, which are surrounded by apparently sound wood. The cell walls are changed into compounds, which diffuse through the walls and fill the cells surrounding the decayed center, and these have been called humus compounds. In both trees a fungus mycelium occurs, with strongly marked characteristics, which flourishes within the diseased centers, and grows between them without affecting the intervening wood. This wood can be utilized for many purposes even when much rotted, and in neither case does the mycelium grow after the tree has once been cut down. The two trees thus diseased, both representatives of a race of trees the majority of which are extinct, are closely related genetically, although growing in different parts of the country. The two forms of decay differ but slightly, and not more than might be expected in two woods of different character.

Mr. J. C. Arthur, of the Purdue University Agricultural Experiment Station, a few years ago picked up a small white flower (*Cerastium arvense oblongifolium*) growing unobtrusively among the grass and low weeds of the roadside. It was a little more attractive than its relative which is called the field chickweed, and the author suggests the name of starry grasswort for it. Under cultivation it spread out over the ground in a close mat of foliage in a manner characteristic of many members of the pink family, to which it belongs; and now for six weeks in April and May it is a mass of "dazzling whiteness, softened with the pale green of stems and leaves," while "all winter long the prostrate stems remain alive to their very tips, and the leaves maintain a summerlike appearance," without the indurated, polished look so usually associated with evergreen foliage. This is one roadside flower taken up, perhaps casually, for cultivation and improvement. There are others—no one knows how many—that will doubtless likewise reward the pains taken with them; and this inspires Mr. Arthur to suggest to others that they keep a lookout for plants that may become desirable garden varieties and try them. "It is evident that showiness in the wild state is not the most important criterion by which to gauge the future culture value of a plant. One needs to have many factors in mind to meet with success, and it is hoped that the

study of the starry grasswort will be suggestive in this line. The byways and fields undoubtedly hold many incipiently valuable decorative plants which await the discoverer, as truly as do those of the unexplored regions of Asia and Africa."

An experiment has been tried in New York during the past summer in the way of "vacation schools" for teaching housekeeping and domestic economy. Instruction was given daily in these arts in the public schoolrooms in Front and Oliver Streets and in Hester Street. At Front and Oliver Streets girls were taught to air, clean, and take care of a bedroom; to set table, clean, and take care of a living room; kitchen cleanliness; laundry work—one week being devoted to each course, and talks were given on furnishing a flat, the care of a cellar, and the importance of air and sunlight to health. The children were also taught daily to cook appetizing dishes and serve them. At Hester Street more time was given to the cooking lessons, instruction was given on the feeding of babies, and a class in nursing was taught; among other things, emergency bandaging, caring for helpless patients, and the hygiene of the sick-room.

Mr. A. P. Coleman, during some geological work last summer on the north shore of Lake Superior, about Heron Bay, discovered a new mineral, which he has named *Heronite*, and which he describes at length in the Journal of Geology for July–August. It is a dike rock, consisting essentially of analcite, orthoclase, plagioclase, and ægyrite, the analcite having the character of a base, in which the other minerals form radiating groups of crystals. The analcite clearly represents the magma left after the crystallization of the imbedded minerals, and it is evident that it can be formed only from a magma highly charged with water, and therefore under pressure.

From the examination of a number of nearly pure hydrocarbons obtained from American petroleum by Young, it appears that the same classes of hydrocarbons, paraffins, polymethylene compounds of naphthenes and aromatic hydrocarbons are present in these and in Russian and Galician petroleums; but that Russian petroleum contains a relatively larger amount of naphthalenes and, in all probability, of aromatic hydrocarbons, than Galician, and Galician a larger amount of the same hydrocarbons than American petroleum.

NOTES.

An old contributor, Dr. A. F. A. King, of Washington, D. C., writes us calling attention to the interesting fact that we printed an article of his as far back as September, 1883, suggesting the mosquito theory of malaria, and giving a number of observations which seemed strongly to support this view.

Experiments made by F. H. Hall and W. P. Wheeler, at the New York Agricultural Experiment Station, regarding the best food for "chicks, pullets, cockerels, and ducklings," seem to indicate conclusively that part of the protein must be drawn from animal sources if we are to get the best results. Rations in which from forty to fifty per cent of the protein was supplied by animal food produced more rapid growth and at less cost of production.

Messrs. A. Stutzer and Hartlieb, of Breslau, have detected bacteria in Portland cements, which provoke the liberation of the nitrogen from nitrogenous compounds in water, and the formation of nitrous and nitric acids that act upon the lime in the cement and promote its disintegration.

According to Industries and Iron, the tides are now utilized for generating power at Pont-l'Abbé, Finisterre, France, during fourteen hours per day. At flood tide the water flows through a canal two miles and a half inland into a pond in the rear of the power house, and returns to the sea at ebb tide. The total fall is seven feet and a half, and eighty-horse power is generated by means of turbines. Means have been considered for applying this method of generating power to various industries.

A proposal for an International Physical Congress has been accepted by the authorities of the Paris Exposition of 1900, and the congress will be held from the 6th to the 12th of August, under the auspices of the French Government. It immediately precedes the International Electrical Congress. So far as has yet been determined, the subjects of the addresses and reports will be classified under the headings of the definition and fixing certain units (of pressure, scale of hardness, quantity of

heat, etc.), the Bibliography of Physics, and National Laboratories. The final programme is, however, still to be settled. The subscription for membership is twenty francs, or four dollars. The foreign secretary of the congress is M. Charles Edouard Guillaume, Pavillon de Breteuil, Sevres (Seine et Oise), Paris.

In a book called Literary Munich Portraits, with brief biographical sketches by Paul Heyse, are given of twenty-five of the most prominent literary men of that brilliant capital. Only two authors not Germans are included. One of them is our contributor, E. P. Evans. The other is the Norwegian novelist Björnson. Heyse leaves himself out, although he is the greatest literary character of them all.

Some recent experiments, conducted jointly by the Kew Observatory Committee and the International Bureau of Weights and Measures at Sèvres, were made to compare the platinum thermometer of Professor Callendar, which measures temperature by the varying resistance of a platinum wire, and the older mercury and gas thermometers. It was found that below 100° C. the differences between the observed values on the nitrogen scale and those deduced from the platinum thermometer are exceedingly small, and that even at the highest temperature (590°) the differences only amount to a few tenths of a degree.

The American Chemical Society has gained 232 members during the past year, making the present number 1,540. The report of the committee on the analysis of coal, submitted to the recent meeting of the society at Columbus, Ohio, embodied detailed instructions in regard to the best methods of analyzing coke, and outlined a plan for securing uniformity in such analysis by chemists throughout the land. This report was adopted.

At the recent annual meeting of the American Society for the Promotion of Agricultural Science Prof. W. J. Beal reported concerning the germination of seeds, after long keeping, that experiments had been tried with various seeds five, ten, fifteen, and twenty years old, from which it appeared that seeds of a large number of important plants would germinate after fifteen years, but the number sprouting after twenty years was small.

A paper was read by Dr. L. O. Howard, at the recent meeting of the American Society of Entomologists, recording the success which has been obtained by the fig-raisers of California in fertilizing the Smyrna variety of figs by the aid of the blastophaga which issues from the Capri figs covered with their pollen. A generation of the blastophaga has been developed at Fresno by which many Smyrna figs have been satisfactorily fertilized, and there is considerable probability that the insect has at last established itself on California soil.

The five hundredth anniversary of the birth of Gutenberg, associated with the invention of printing, is to be celebrated at Mayence, June 24, 1900. It is hoped that the foundation of a Gutenberg Museum may be a result of this movement. An exhibition illustrating the art and progress of printing is also expected to be held.

The conclusion is drawn by the Italian, Signor Albini, from investigations on the nutritive value of whole-meal bread, that it is inferior to that of ordinary white bread, and that a further disadvantage comes from the excessive quantity of indigestible matter, formed of the harder parts of the pericarp of the grain, which it contains.

We have to add to our obituary list of men known in science the names of Edward Orton, LL. D., Professor of Geology in Ohio State University, late State Geologist of Ohio, and late President of the American Association for the Advancement of Science, at Columbus, Ohio, October 16th, in his seventy-first year, of whom we shall shortly give a more extended sketch, with portrait; Grant Allen, writer of several scientific books and articles, and a contributor to the Popular Science Monthly; Prof. Theodore Elbert, German geologist, aged forty-two years; Dr. Max Barth, Director of the Agricultural Station of Rufach, Alsace, aged forty-four years; M. Paul Janet, member of the Paris Academy of Moral Science, and formerly professor at the Sorbonne; Edward Case, English engineer, well known for his method of groining to prevent the sea from encroaching on the coast, September 22d; Hamilton Y. Castner, whose name is associated with the establishment of processes for the electrolytic production of alkali and bleaching powder from common salt, and for the extraction of aluminum; Dr. Oscar Baumann, of Vienna, African explorer, author of a map of the Congo, geographical articles, and books relating to his explorations; and Dr. J. W. Hicks, Bishop of Bloemfontein, formerly demonstrator in chemistry in the University of Cambridge, and author of a text-book on inorganic chemistry.